# CHEMICAL ENGINEERING

VOLUME 96

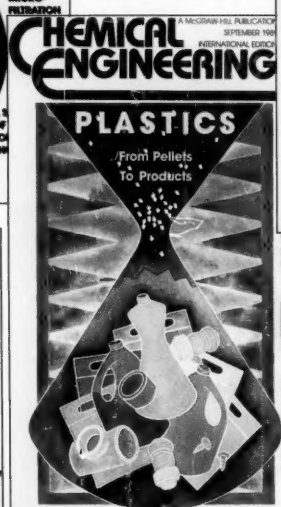
A McGRAW-HILL PUBLICATION

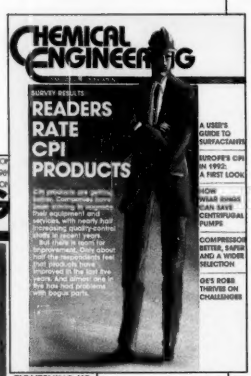
**ALAN R. MORRIS** *Vp/Publisher*

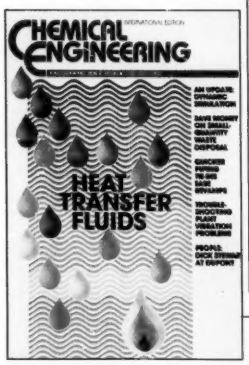
**RICHARD J. ZANETTI** *Editor-In-Chief*

**Eighty-seven years ago, the McGraw-Hill Publishing Co. founded a monthly magazine called *Electrochemical Industry.* This was the first magazine launched by the fledgling publishing firm. It was renamed *Electrochemical and Metallurgical Industry* in 1905, and a year later absorbed the magazine *Iron & Steel.* In 1910, its title became *Metallurgical and Chemical Engineeering.* Seven years later the McGraw-Hill company was formed, incorporating the magazine operations of the McGraw and Hill publishing firms. A few months thereafter, *Metallurgical and Chemical Engineering* had its name changed again to *Chemical and Metallurgical Engineering.* This appelation remained until 1946, when the current title—*Chemical Engineering*—was adopted. *Chemical Engineering* has had a continuous history of 87 years, and carries the distinction of being the first magazine to have been formed by either company.**

CHEMICAL ENGINEERING
FLEXIBLE-IMPELLER PUMPS
THE U.K.'s CPI REBOUND TO MEET NEW CHALLENGES
HOW BEST TO USE CROSSFLOW MICRO-FILTRATION
WHEN AND HOW TO USE THEM




## A JAN.- DEC. 1989 ALPHABETICAL INDEX


**Absorption**
Better absorption? Try a static mixer. Robert G. Rader & others (diagrams, graphs) ..... July *137
First commercial use of absorption in a solvent-recovery application in West Germany (C) ..... Mar 17
Forager sponge absorbs heavy metal pollutants (C) ..... Sept 21
—Postscripts, corrections ..... Nov 8
Polymer sinter, Porosoft, from Japan has novel absorption properties (C) .... Oct 25

**Achemasia 89**
Achemasia invests in the future. Richard Zanetti (N) ..... Nov *58
AchemAsia middleman—Letter .... May 7

**Additives**
Fuel additive that lowers an engine's octane need by about 70%, cuts hydrocarbon emissions and improves fuel economy announced (C) ..... Jan 17
—Postscripts, corrections ..... Mar 7

**Adsorption**
Dow resin adsorption system for removing bitterness from orange juice being used by CCPI (C) ..... June 21
UC's VPSA: Gas separation technology boasts lower costs (C) ..... Oct 17
Zeolite out-performs activated carbon in solvent removal at Swedish painting facility (C) ..... Nov 17

**Agglomeration**
Boon for solids handling: Agglomeration. Gerald Parkinson (N) ..... Aug *37
Electrostatic device agglomerates small particulates (C) ..... Sept 19
Aggregates—Australia's Neutralysis' novel way of making light aggregate uses wastes as fuel and a feedstock (C) .. May 25

**Air Pollution**
Acid rain
Acid-rain legislation ought to mandate a total 10-million-ton reduction in $SO_2$ emissions (C) ..... Mar 27
Coal ash may offset acid rain damage: new West German compound (C) Dec 19
Air pollution control costs: People are prepared to pay more for a cleaner environment (C) ..... May 27
Air toxics: Bill to reduce emissions of toxic air pollutants introduced (C) ..... May 27
Airborne toxics regulation: need appears unassailable (C) ..... May 27
Analytical technique may detect contaminants down to 0.01 ppt (C) ..... Sept 25
Automotive
ARCO's new gasoline reduces emissions (C) ..... Sept 25
Gasoline: summer volatility rules for gasoline require lowering Reid Vapor Pressure (C) ..... Apr 27
Benzene emissions: EPA seeks to cut benzene emissions by 90% (C) ..... Oct 25
California's ARB takes a step toward anti-smog computers (N) ..... Oct 68G
California: California diesel fuel gets stricter standards. Gerald Parkinson (N) ..... Jan 42
SCAQMD to vote on plan to phase out the use of petroleum-derived and solid fossil fuels (C) ..... Feb 25
Seeking clear skies in California (N) Aug 35
Southern California's clean-air plan gets the green light (C) ..... Sept 25
Chemical companies emitted over 1/3 of the chemicals released to the air in 1987 (C) ..... Apr 25
Clean Air Act
Bush Administration's proposal to revise the Clean Air Act getting mixed reviews (C) ..... July 25
The debate starts anew on clean air. Dennis Melamed & Gerald Parkinson (N) ..... Aug *31


NOTES—*Illustrated; (C) Chementator; (Ed) Editor's Page; (N) Newsfront; (P.N.) Plant Notebook; (R) Reprints available

# CHEMICAL ENGINEERING

VOLUME 96

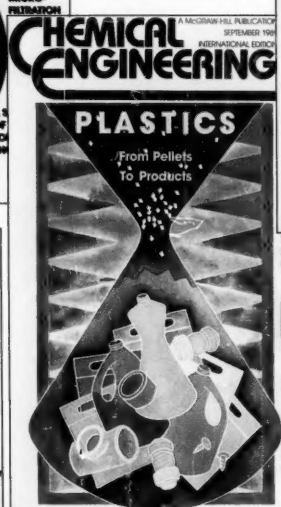
A McGRAW-HILL PUBLICATION

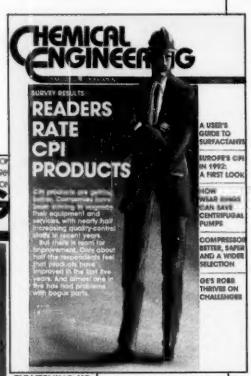
**ALAN R. MORRIS** *Vp/Publisher*

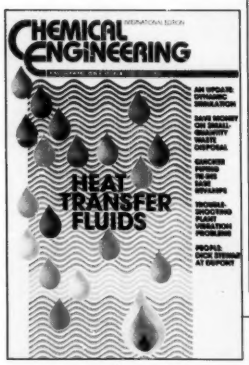
**RICHARD J. ZANETTI** *Editor-In-Chief*

**Eighty-seven years ago, the McGraw-Hill Publishing Co. founded a monthly magazine called *Electrochemical Industry.* This was the first magazine launched by the fledgling publishing firm. It was renamed *Electrochemical and Metallurgical Industry* in 1905, and a year later absorbed the magazine *Iron & Steel.* In 1910, its title became *Metallurgical and Chemical Engineeering.* Seven years later the McGraw-Hill company was formed, incorporating the magazine operations of the McGraw and Hill publishing firms. A few months thereafter, *Metallurgical and Chemical Engineering* had its name changed again to *Chemical and Metallurgical Engineering.* This appelation remained until 1946, when the current title—*Chemical Engineering*—was adopted. *Chemical Engineering* has had a continuous history of 87 years, and carries the distinction of being the first magazine to have been formed by either company.**

CHEMICAL ENGINEERING
FLEXIBLE-IMPELLER PUMPS
THE U.K.'s CPI REBOUND TO MEET NEW CHALLENGES
HOW BEST TO USE CROSSFLOW MICRO-FILTRATION
WHEN AND HOW TO USE THEM




## A JAN.- DEC. 1989 ALPHABETICAL INDEX


**Absorption**
Better absorption? Try a static mixer. Robert G. Rader & others (diagrams, graphs) ..... July *137
First commercial use of absorption in a solvent-recovery application in West Germany (C) ..... Mar 17
Forager sponge absorbs heavy metal pollutants (C) ..... Sept 21
—Postscripts, corrections ..... Nov 8
Polymer sinter, Porosoft, from Japan has novel absorption properties (C) .... Oct 25

**Achemasia 89**
Achemasia invests in the future. Richard Zanetti (N) ..... Nov *58
AchemAsia middleman—Letter .... May 7

**Additives**
Fuel additive that lowers an engine's octane need by about 70%, cuts hydrocarbon emissions and improves fuel economy announced (C) ..... Jan 17
—Postscripts, corrections ..... Mar 7

**Adsorption**
Dow resin adsorption system for removing bitterness from orange juice being used by CCPI (C) ..... June 21
UC's VPSA: Gas separation technology boasts lower costs (C) ..... Oct 17
Zeolite out-performs activated carbon in solvent removal at Swedish painting facility (C) ..... Nov 17

**Agglomeration**
Boon for solids handling: Agglomeration. Gerald Parkinson (N) ..... Aug *37
Electrostatic device agglomerates small particulates (C) ..... Sept 19
Aggregates—Australia's Neutralysis' novel way of making light aggregate uses wastes as fuel and a feedstock (C) .. May 25

**Air Pollution**
Acid rain
Acid-rain legislation ought to mandate a total 10-million-ton reduction in $SO_2$ emissions (C) ..... Mar 27
Coal ash may offset acid rain damage: new West German compound (C) Dec 19
Air pollution control costs: People are prepared to pay more for a cleaner environment (C) ..... May 27
Air toxics: Bill to reduce emissions of toxic air pollutants introduced (C) ..... May 27
Airborne toxics regulation: need appears unassailable (C) ..... May 27
Analytical technique may detect contaminants down to 0.01 ppt (C) ..... Sept 25
Automotive
ARCO's new gasoline reduces emissions (C) ..... Sept 25
Gasoline: summer volatility rules for gasoline require lowering Reid Vapor Pressure (C) ..... Apr 27
Benzene emissions: EPA seeks to cut benzene emissions by 90% (C) ..... Oct 25
California's ARB takes a step toward anti-smog computers (N) ..... Oct 68G
California: California diesel fuel gets stricter standards. Gerald Parkinson (N) ..... Jan 42
SCAQMD to vote on plan to phase out the use of petroleum-derived and solid fossil fuels (C) ..... Feb 25
Seeking clear skies in California (N) Aug 35
Southern California's clean-air plan gets the green light (C) ..... Sept 25
Chemical companies emitted over 1/3 of the chemicals released to the air in 1987 (C) ..... Apr 25
Clean Air Act
Bush Administration's proposal to revise the Clean Air Act getting mixed reviews (C) ..... July 25
The debate starts anew on clean air. Dennis Melamed & Gerald Parkinson (N) ..... Aug *31


NOTES—*Illustrated; (C) Chementator; (Ed) Editor's Page; (N) Newsfront; (P.N.) Plant Notebook; (R) Reprints available

Clean Air battle heats up over alternative fuels for vehicles (C) ..... Nov 27
Czech antipollution drive picks up speed. Eric Johnson (N) ..... Oct 62
Duct injection may be an alternative to scrubbing in existing power plants (C) ..... Feb 23
Great Britain: m... ...ar-sieve system for capturing fugitive emissions will be pilot tested (C) ..... Feb 19
Legislation: Senate Committee prepares air pollution bill (C) ..... Oct 27
MTR's membranes remove 90-99% of chlorofluorocarbons from air streams (C) ..... May 25
Ozone controversy
CFC alternatives see **Chlorofluorocarbons**
The Greenhouse effect...and the Green Man—Letters ..... May 7
$CCl_4$ and $CH_3CCl_3$ may be added to the Montreal Protocol (C) ..... May 27
CFCs: Tax, don't ban, CFCs—Letter ..... Aug 7
Tax proposal could make chlorofluorocarbons more expensive to use (C) Aug 19
Irvine, CA passes toughest law on ozone-depleting compounds (N) . Aug 52
Greenhouse gases: international movement to regulate emissions (N) . Aug 56
Quick conversion of $NO_x$ and CO emission rates. V. Ganapathy (P.N.) (charts) Dec 149
Sulfur removal see **Desulfurization**
Two-stage de-$NO_x$ route that injects urea and methanol removes 65-80% of nitrogen oxides from fluegas (C) ..... July 19
UC system in which supercritical $CO_2$ replaces hydrocarbon solvents could reduce emissions of volatile organic compounds from paints by 30-70% (C) . Aug 11

**Alcohol**
Ethanol see **Ethanol**
Hydrocarbons can be converted to industrial alcohol in a single step with catalysts developed at Univ. of Calif. (C) May 17
Methanol see **Methanol**
Oxo alcohols see **Oxo Alcohol**
Alkanes—How to predict *n*-alkane densities. Charles H. Fisher (P.N.) ..... Oct 195
Alloys—A reliable base for high-nickel equipment. James L. Gossett (tables) May *145

**Alumina**
Alcan reports improved iron-oxide removal by activated-sand filters (C) ..... Mar 23
Flocculant for alumina production that offers better process-liquor clarity from American Cyanamid (C) ..... Mar 23
Reynolds Metals plans modernization projects for Sherwin alumina plant (N) Sept 69
Aluminum—Recycling salt slag from aluminum manufacturing in Italy (C) .... Sept 23

**American Institute of Chemical Engineers**
Center For Waste Reduction Technologies to be formed (C) ..... Dec 25
Education Dept. offers instructional videotapes on chemical process safety (C) ..... May 21
Loss prevention symposium—Letter Feb 7
Petro Expo '89 Preview ..... Mar *85

**Ammonia**
Mass spectrometer designed for online ammonia-production analysis and optimization (C) ..... Apr 21
$NH_3$ break thru: Small plants; ICI's Leading Concept Ammonia process. Herb Short (N) (flowchart) ..... July *41

**Analyzers**
Analyzer takes a fast reading (P.N.) July *184
Industrial-dryer efficiency may be improved by an online moisture analyzer (C) ..... Aug 15
—Letter ..... Oct 8
Mass spectrometer designed for online ammonia-production analysis and optimization (C) ..... Apr 21
NIST researchers develop more-sensitive way to analyze substances for ICP-MS technique (C) ..... Mar 25
Portable waste analyzer gives immediate results (C) ..... Oct 19
Anniversaries—The New York Blower Co.: A hundred years later, ingenuity is still blowing strong (N) ..... Oct *62
Applied Biotreatment Assn.—Bioremediation industry establishes a trade association (C) ..... Apr 27

**Artificial Intelligence**
Real-time expert system for chlorine production: major project of ESPRIT (C) ..... Mar 25
Westinghouse computer figures out a better way to make metal tubes (N) . Dec 48D

**Atomic Power**
DOE awards contract to manage nuclear-waste to a consortium (C) ..... Jan 27
DOE's Savannah River facility will be operated by Westinghouse (C) ..... Mar 23
EPA shuns the Energy Dept.'s nuclear clean-up plan (C) ..... Sept 27
Nuclear power reactor: information please—Letter ..... Feb 7
NRC approves changes in the licensing process for new nuclear power plants (N) ..... June 66F
Three Mile Island Unit 2 cleanup almost finished (N) ..... June 66E

**Australia**
Microwave 'factory' speeds synthesis of chemical compounds (C) ..... Nov 17
Neutralysis' novel way of making light aggregate uses wastes as fuel and a feedstock (C) ..... May 25

**Austria**
Chemie Linz route yields higher-purity glyoxylic acid and no wastewater (C) ..... Mar 21
Fluegas-desulfurization scheme uses fly-ash (C) ..... Oct 17
Proprietary route for making higher-purity levulinic acid (C) ..... May 17

**Automation**
Automated waste recovery cuts materials and disposal costs (P.N.) ..... Jan *150
Automatic process control for pilot plants: Dow-developed product, the Camile data-acquisition and control unit (F.N.) ..... June *181
Papermakers go electronic. Nicholas Basta (N) (charts) ..... Mar *30
—Postscripts, corrections ..... June 8

**Automobiles**
Air pollution
ARCO's new gasoline reduces emissions (C) ..... Sept 25
California's diesel fuel gets stricter standards. Gerald Parkinson (N) Jan 42
California's SCAQMD's clean-air plan (C) Feb 25, (N) Aug 35, (C) ..... Sept 25
Gasoline: Summer volatility rules for gasoline require lowering Reid Vapor Pressure (C) ..... Apr 27
Fuel: Bush Administration ponders new alternative-fuels program (C) .... Dec 27
Fuel: Clean Air battle heats up over alternative fuels for vehicles (C) ..... Nov 27
Fuel: Methanol—too expensive for auto fuels? (C) ..... Dec 21
Fuel: U.S. industry group to test cleaner auto fuels (C) ..... Nov 21
Plastics: Autos set a fast pace for thermoplastics. Benno Groeneveld (N) (table) ..... Feb 35

**Awards**
Dow Chemical will get the World Environment Center's 1989 Gold Medal (C) Jan 19
1989 Kirkpatrick Chemical Engineering Achievement Award (30th biennial)
Engineering excellence will be honored again ..... Feb 59
Union Carbide, three others win 1989 Kirkpatrick Awards (C) ..... Oct 19
The Kirkpatrick Award (Ed) ..... Dec 5
The tops in chemical engineering achievement. Nicholas P. Chopey
Winner: Union Carbide's novel oxygen enhanced combustion of hazardous wastes (diagram) ..... Dec *79
Honorable Mentions
Allied-Signal Aquatech acid recovery system (diagram) ..... Dec 81
BioTechnetics mammalian-cell bioreactor (diagram) ..... Dec 82
Mobil selective toluene disproportionation (diagram) ..... Dec *83


## B


**Bacteria**
Biodegradable plastics from potato waste (C) ..... Sept 19
"Biostimulation" test by Stanford: bugs feast on vinyl chloride and other goodies (C) ..... Nov 25
Cleaning up contaminated waste sites—report. David R. Hopper (map, tables, flowsheets, diagrams) (R) ..... Aug *94
Cleaning up a lagoon through bioremediation ..... Aug 106
—Letters ..... Nov 8
GE successfully employs biodegradation for destroying PCBs in contaminated river sediments (N) ..... Dec 48D
Japan's Superbugs Project
Bacterium thrives on chemical solvents (C) ..... Oct 21
Producing magnetic particles in bacteria (C) ..... Oct 23
Native microorganisms being tested for cleaning up oil spill in Prince William Sound, Alaska (C) ..... July 25
PCBs destroyed in a single step with new bacteria (C) ..... Sept 21
Process for treating hot effluents—45-75°C, vs. 25-35°C for methods using conventional microorganisms—will be tested at Kuwaiti complex (C) ..... July 19
Stimulated bugs guzzle up TCE (C) . Nov 25
Trichloroethylene cleanup planned by Combustion Engineering (C) ..... Dec 17
West German biotech-permit battle erupts over BASF plans to build pilot unit that would use genetically engineered bacteria (C) ..... July 25
BASF fights for its anti-cancer agent (C) ..... Oct 25
Baghouses—A hot and dirty future for baghouses. Gerald Parkinson (N) ..... Apr *30
—Postscripts, corrections ..... June 8
—Letter ..... Sept 8

**Batch Operations**
Batch controller helps boost output (P.N.) ..... Mar *187
Distributed control report: DCS for batch process control. Donald J. Modell (diagrams, tables) ..... May *97
Heat-transfer fluid solves coking problems (P.N.) ..... Sept *215
Herzog-Hart's M.O.S.T. concept: A way to design and build batch fine-chemical plants cost-effectively (C) ..... Apr 17
How to predict batch-reactor heating and cooling. John McEwan (P.N.) ..... May 179

**Bearings**
Equipment Focus: Seals and packings ..... June *99
Equipment and services ..... June *99
Bigger and better seals and bearings handle diverse applications .... June *101
Belgium—Exxon starts up high-pressure polyethylene pilot unit (C) ..... July 25
Belt Cooler—Get more out of your belt cooler. Per Lindén (graphs, table) ..... Sept 170

**Benzene**
EPA seeks to cut benzene emissions by 90% (C) ..... Oct 25
Mobil R&D's disproportionation of toluene into benzene wins Kirkpatrick Honor Award (C) ..... Oct 19
Mobil selective toluene disproportionation—Kirkpatrick Honorable Mention (diagram) ..... Dec *83

**Biomass**
Biomass-to-phenolics route moves closer to market (C) ..... Sept 25
DOE asks for "expressions of interest" in building a medium-Btu biomass gasifier (C) ..... Jan 21


NOTES—*Illustrated; (C) Chementator; (Ed) Editor's Page; (N) Newsfront; (P.N.) Plant Notebook; (R) Reprints available

German route converts liquefied dung to environmentally acceptable fertilizer (C) ... Apr 23

**Biotechnology**

Bioremediation industry has established a trade association, the Applied Biotreatment Assn. (C) ... Apr 27
Biotech sales will grow, despite... —BCC study (N) ... Mar 64
BOM process for removing metal contaminants from wastewater: Varied technical menu at metals meeting. Gerald Parkinson (N) ... Apr 52
Chiron licenses Phillips' yeast gene to make pharmaceuticals (N) ... Oct 64
EPA expected to propose biotechnology regulations under TSCA (C) ... Jan 27
Field tests
North Carolina law that allows the state to veto field testing of genetically engineered organisms getting mixed reviews from biotech industry (C) Sept 27
In vitro injection of DNA coded to produce pharmaceutical proteins in the eggs of cows (C) ... Aug 9
Millipore has opened a joint biotechnology R&D center in the U.S.S.R. (C) ... Feb 23
West German biotech-permit battle erupts over BASF plans to build pilot unit that would use genetically engineered bacteria (C) ... July 25
BASF fights for its anti-cancer agent (C) ... Oct 25

**Blending**

Equipment Focus: New twists in mixers and blenders ... Jan *127
Equipment and services ... Jan 128
Manufacturers' literature ... Jan 134
—Postscripts, corrections ... Mar 7

**Boilers**

ASME Boiler and Pressure Vessel Code is going electronic (C) ... May 19
'Superclean' coal-water slurry will be test-burned in oil-fired boiler (C) ... Oct 23

Bonding—Particle-modification technology, The Hybridizer, now available in the U.S. (C) ... Apr 19

Bonner, Timothy A. of Monsanto—Understanding customers. Sandy Edwards June *69

**Book Reviews**

Chemical engineering economics. Donald E. Garrett ... Aug 182
Chemical process equipment—selection and design. Stanley M. Walas ... Jan 165
Comprehensive polymer science—the synthesis, characterization, reactions & applications of polymers. Seven volumes. Ed. Sir Geoffrey Allen, FRS & John C. Bevington ... Mar 201
The consolidated chemical regulation guidebook. Volumes 1 & 2. Andrew B. Waldo ... Oct 209
Directory of world chemical producers 1989/1990 ... July 195
Encyclopedia of fluid mechanics: Volume 7: Rheology and non-Newtonian flows; Volume 8: Aerodynamics and compressible flows. Ed. Nicholas P. Cheremisinoff ... Apr 187
Encyclopedia of physical sciences and engineering information sources. 1st Edit. Ed. Steven Wasserman, Martin A. Smith & Susan Mottu ... Nov 281
Handbook of hazardous waste incineration. Calvin R. Brunner ... May 191
An introduction to numerical methods for chemical engineers. James B. Riggs ... June 199
Legal and ethical concepts in engineering. Keith W. Blinn ... Dec 163
The safe handling of chemicals in industry, Volumes 1 and 2. P.A.Carson & C.J. Mumford ... Sept 227
Standard handbook of powerplant engineering. Thomas C. Elliot and the editors of *Power* magazine ... Feb 167

Bricks—Inspection: Key to quality masonry lining. Walter Lee Sheppard, Jr. ... Mar *191

Bus, methanol-powered, goes into service in LA (N) ... June 66H


## C


Calculator Programs—A shortcut technique for finding $H_2SO_4$ concentration. C.M. Davidson (P.N.) (table) ... Mar 185

**Canada**

Alcan reports improved iron-oxide removal from alumina by a activated-sand filters (C) ... Mar 23
Du Pont planning HCFC-123 facility (N) ... Aug 56C
Minerals, as well as petroleum, may be recovered from Canadian tar sands through Solv-Ex process (C) ... Apr 17
Mist eliminators help raise sulfur-removal capacity at Kidd Creek (P.N.) ... Nov *263
Pulp and paper: major investments in the pulp and paper industry announced for Alberta (C) ... Jan 19

**Carbon Dioxide**

DOE looking for technologies that control carbon dioxide in third solicitation for clean-coal demonstration projects (C) ... June 25
Greenhouse gases: international movement to regulate emissions (N) ... Aug 56
Ozone controversy see **Ozone**
UC system in which supercritical $CO_2$ replaces hydrocarbon solvents could reduce emissions of volatile organic compounds from paints by 30-70% (C) ... Aug 11

Carbon Monoxide—Quick conversion of $NO_x$ and CO emission rates. V. Ganapathy (P.N.) (chart) ... Dec 149

**Careers**

Calculate your job enjoyment. John Gillett ... June *164
Change jobs or stay put? Eugene Raudsepp (job satisfaction inventory questionnaire) ... June *161
Family concerns are playing an increasingly important role in career choices: Du Pont survey (C) ... Feb 17
The total system of job search. Kenneth & Sheryl Dawson
Part 1: Résumés ... Apr *158
Part 2: Reference-building, networking, interviewing, negotiating ... May *165
Women engineers: The playing field isn't level. Suzanne Shelley (N) ... Dec *47

Castings—A reliable base for high-nickel equipment. James L. Gossett (tables) May *145

**Catalysts**

Conjuring up catalysts (Ed) ... Sept 5
Designer catalysts are all the rage. Gerald Parkinson & Eric Johnson (N) ... Sept *30
—Letter ... Dec 7
Exxon catalysts make better polymers (C) ... Nov 23
HDCs: new catalysts destroy volatile organics at lower incineration temperatures (C) ... July 19
Hydrocarbons can be converted to industrial alcohol in a single step with catalysts developed at Univ. of Calif. (C) May 17
Shell Nederland hydrogenation process uses a continuous circulating catalyst (N) ... Aug 56G
Sumitomo catalyst removes more sulfur from petroleum (C) ... Nov 17

Cell Culturing—BioTechnetics' immobilized-cell bioreactor wins Kirkpatrick Honor Award (C) ... Oct 19
BioTechnetics mammalian-cell bioreactor—Kirkpatrick Honorable Mention (diagram) ... Dec *82

Centrifuges—A larger centrifuge separates more materials in less time for Dow (P.N.) ... Jan *149

**Ceramics**

Abrasion-resistant ceramic membranes being evaluated as media to separate pollutants from high-temperature gases (C) ... Jan 25
Baghouses: A hot and dirty future for baghouses. Gerald Parkinson (N) ... Apr *30
—Postscripts, corrections ... June 8
Ceramic fibers made by laser-based chemical-vapor-deposition process (C) ... July 17
Inhalation of refractory ceramic fibers may pose a health hazard (C) ... Apr 25
Mitsui to commercialize a high-temperature superconductor (C) ... Nov 21
Vacuum pump from Japan features ceramic rotor assembly (C) ... Oct 17

**Chem Show '89**

Chem Show Preview ... Nov *93
New products and services highlights ... Nov *95
Show highlights ... Nov 116

"Chemical Engineering"—A satisfied customer—Letter ... Sept 8

**CE Refresher**

Nondestructive testing in the CPI. Frank J. Sattler (charts, diagrams)
Part 1: Improving quality through nondestructive testing ... Apr *116
Part 2: Finding surface defects with nondestructive testing ... July *125
Part 3: Finding below-surface defects with nondestructive testing ... Sept *161
Part 4: Nondestructive testing via optical and acoustical methods ... Nov *191
Part 5: Improving plant maintenance via nondestructive testing ... Dec *115

**CE Tutorial**

Numerical methods. Bernard Y. Tao (charts, tables, diagrams) (R)
7. Linear programming ... July 146

**Chemical Industry**

Dow Chemical forming Destec Energy, Inc. (N) ... June 58

Mergers & acquisitions
Brown & Root acquires C F Braun, Inc. (C) ... Sept 21
Elf Aquitaine will acquire Pennwalt in a friendly takeover (C) ... Apr 25
European Vinyls Corp. acquires the vinyls technology and licensing business of Stauffer from ICI Americas (N) ... Feb 48F
Italy: Enimont will soon become a reality (N) ... Jan 48D
Portugal moves to privatize its CPI. Eric Johnson (N) ... July 52
Sovitex, joint venture between Italian and Soviet engineering firms (N) ... June 66H

Chemical Weapons—Chemical-weapons furor pricks the CPI; illegal exports by West German firms. Eric Johnson (N) ... Mar 47

**China**

Achemasia invests in the future. Richard Zanetti (N) ... Nov *58
Red carpet welcome for U.S. waste paper. Reginald Rhein (N) ... Mar 64E

Chlorine—Real-time expert system for chlorine production: major project of ESPRIT (C) ... Mar 25

**Chlorofluorocarbons**

Alternative CFC cleaning agents—90% less damaging to the ozone layer (C) Apr 25
Alternatives: Du Pont develops substitutes for CFCs that can be used in existing equipment (C) ... Feb 21
Alternatives: Du Pont planning HCFC-123 facility (N) ... Aug 56C
Alternatives: EPA may require more tests of CFC substitutes (C) ... Nov 19
Alternatives: ICI to invest $100 million in CFC-alternative plant for HFC-134a (C) ... Nov 19
Alternatives: It's market time for CFC alternatives (N) ... Nov 60
Greenpeace targets West German CFC producers (C) ... Oct 23
MTR's membranes remove 90-99% of chlorofluorocarbons from air streams (C) ... May 25

Ozone controversy
The greenhouse effect...and the Green Man—Letters ... May 7
$CCl_4$ and $CH_3CCl_3$ may be added to the Montreal Protocol (C) ... May 27
Production of chlorofluorocarbons will end by the year 2000 in 81 countries (C) ... June 19
Tax, don't ban, CFCs—Letter ... Aug 7


NOTES—*Illustrated; (C) Chementator; (Ed) Editor's Page; (N) Newsfront; (P.N.) Plant Notebook; (R) Reprints available

Tax proposal could make chlorofluorocarbons more expensive to use (C)Aug 19
Irvine, CA passes toughest law on ozone-depleting compounds (N) . Aug 52
Greenhouse gases: international movement to regulate emissions (N) . Aug 56
Taxes: House approves taxes on CFCs, crude oil (C) ..... Nov 27
Process to recover CFCs from ethylene oxide sterilant (C) ..... Jan 23
Chromates—Non-chromates vie for a cooling water niche. Susan Irving-Monshaw (N) ..... Sept *59

**Chromatography**
Supercritical-fluid chromatography could cut solvent costs five-to-ten-fold (C)Mar 17
Unocal's continuous chromatographic separation system (N) ..... May 48
Citrus Juice—Dow resin adsorption system for removing bitterness from orange juice being used by CCPI (C) ..... June 21

**Clay**
Australia's Neutralysis' novel way of making light aggregate uses wastes as fuel and a feedstock (C) ..... May 25
Flyash can make clay landfill-liners better barriers to organic contaminants (C)Aug 17

**Cleaning**
Flush away equipment problems. Richard P. Palluzi (table, graphs, diagrams) Jan *104
Steam cleaning for dirty soil (P.N.) . May *180
Sweden: A sound method for degreasing metal parts (C) ..... Oct 23
Clothing—Chemical resistance of protective clothing can be evaluated quickly by CPCtest system (C) ..... June 25

**Coal**
Cleaning up coal's dirty reputation: DOE selects 16 projects for funding under ICCT program. Jayadev Chowdhury (N) ..... Mar *39
DOE looking for technologies that control carbon dioxide in third solicitation for clean-coal demonstration projects (C) ..... June 25
Clean coal solicitation attracts 47 proposals (C) ..... Oct 27
Clean Coal projects: DOE moves on five more Clean Coal projects (C) ... Dec 27
Coal ash may offset acid rain damage: new West German compound (C) ..... Dec 19
Gasification see **Gasification**
Process removes up to 90% of pyritic sulfur from coal via microbubble column flotation (C) ..... July 17
Sludge and ash are combined to make construction material (C) ..... Dec 23
Slurries: startup of a "fully integrated" coal-water-slurry project begins in the U.S.S.R. (C) ..... Jan 23
Slurries: 'superclean' coal-water slurry will be test-burned in oil-fired boiler (C) ..... Oct 23

**Coatings**
Equipment Focus: Coatings and floorings—Some handy new ways to fight corrosion ..... Mar *161
Protective-coating products ..... Mar 162
Problem-resistant flooring ..... Mar 164
Manufacturers' literature ..... Mar 169
Equipment Focus: Corrosion-resistant coatings slash maintenance costs . Dec *125
Equipment and services ..... Dec 126
Manufacturers' literature ..... Dec 133
Keep the wear out of pump wear rings. Colin McCaul ..... Oct *149
USDA developing edible, transparent coatings: goal of research program is sliced fruits and vegetables that stay fresh for at least a week (C) ..... May 21
Coking—Heat-transfer fluid solves coking problems (P.N.) ..... Sept *215

**Columns**
Designing sieve tray columns. Scott D. Barnicki & James F. Davis (diagrams, tables) ..... Oct 140
Part 1: Tray design ..... Oct 141
Part 2: Column design and verification ..... Nov 203
A new correlation for sieve trays. Thomas J. Ward (P.N.) (graphs) ..... June 177
Troubleshooting distillation columns. Mark E. Harrison & John J. France (charts, graphs, diagrams)
Part 1: Technique and tools ..... Mar *116
Part 2: Packed columns ..... Apr *121
Part 3: Trayed columns ..... May *126
Part 4: Auxiliary equipment ..... June *130

**Combustion**
Circulating-bed combustion system being evaluated to clean up McColl Superfund site in Calif. (C) ..... Jan 23
FBC—Cleaning up coal's dirty reputation: DOE selects 16 projects for funding under ICCT program. Jayadev Chowdhury (N) ..... Mar *39
Pulse combustion gets a big tryout at pulp mill. Gerald Parkinson (N) ..... July 51
UC technology for use of oxygen-enhanced combustion in mobile hazardous-waste incinerators wins 1989 Kirkpatrick Award (C) ..... Oct 19
UC's oxygen-combustion technology wins a process patent (C) ..... Dec 17
UC's novel oxygen-enhanced combustion of hazardous wastes wins 1989 Kirkpatrick Chemical Engineering Achievement Award (diagram) . Dec *79
Zurn Industries is licensing Pedco's combustion technology (N) ..... June 66H

**Communications**
Crisis management—Preparation: The key to crisis control. Roy M. Starks, Jr. ..... June *171
How to speak so facts come alive. Morey Stettner ..... Sept *195
Videotapes: It's *fast forward* for CPI videomakers. Susan Irving-Monshaw (N) ..... Oct *37
Communications
See also **Data Communications**

**Composites**
Equipment Focus: Composites lead the way in equipment construction ... Nov *215
Materials and equipment ..... Nov 217
Manufacturers' literature ..... Nov 222
Microporous membranes improve composites molding (P.N.) (diagram) ..... Sept *211

**Compressors**
Compressor choices expand. Gerald Parkinson (N) ..... Oct *47
Compressor performance: Key things to remember. Roland P. Lapina (diagrams) ..... Aug *122
Controller raises air and process capacity. Jon Pratt (P.N.) ..... Feb *151

**Computers**
Array processors speed up your computer. L. Cifuentes ..... Mar *175
California's ARB takes a step toward anti-smog computers (N) ..... Oct 68G
Compatibility is the buzzword on the plant floor (Ed) ..... Nov 5
Computer models
Dynamic simulation: Accelerating interest in dynamic simulation. David Hunter & others (N) ..... Feb *30
Dynamic simulation: A once exclusive club (Ed) ..... Feb 5
Fire modeling: Hazard I (N) ..... Oct 64
Modeling-help wanted—Letter ....Jan 7
Simulation see also **Computers—Software**
A smart process simulator makes its debut (C) ..... Oct 25
Supercomputing gets a foot in the door. Nicholas Basta (N) ..... Dec *30
Designing sieve tray columns. Scott D. Barnicki & James F. Davis (diagrams, tables) ..... Oct 140
Part 1: Tray design ..... Oct 141
Part 2: Column design and verification ..... Nov 203
Desktop products for process control. Len Egol ..... Dec *157
Distributed control: A primer—report May *87
Understanding distributed control. Dale R. Snyder ..... May *87
Controlling continuous processes with DCS. John C. Funk & Larry McAllister (charts) ..... May *90
DCS for batch process control. Donald J. Modell (diagrams, tables) ..... May *97
Engineering workstations improve productivity. Benjamin T. Condon (diagrams) ..... May *104
Equipment Focus: Electronics aid bulk materials handling ..... Sept *179
Manufacturers' literature ..... Sept 189
—Letter ..... Nov 8
Equipment Focus: Need still higher efficiency? Look to instrumentation .. Mar *104
New equipment ..... Mar 104
Brochures and catalogs ..... Mar 112
Graphics: Brighten up computer graphics. Len Egol ..... Oct *201
ISA conference and exhibition preview: Philly hosts ISA/89 ..... Sept *97
ISA show highlights ..... Sept *99
PCs invade new CPI frontiers. Nicholas Basta (N) ..... Apr *43
The microprocessor scorecard .... Apr 47
Software
ASME Boiler and Pressure Vessel Code is going electronic (C) ..... May 19
An armload of process programs. Len Egol ..... July *165
Aspen hits Europe (N) ..... Jan 48H
—Letter ..... Apr 7
Compute relative humidity *quickly*. P.H. Pallady (P.N.) ..... Nov 255
Computers help fill the engineering gap. Len Egol ..... Sept *217
Desktop publishing: For dressing up engineers' reports. Len Egol ..... May *185
Equipment Focus: The expanding world of computer software ..... Aug *113
Equipment and services ..... Aug 113
Fire modeling: Hazard I (N) ..... Oct 64
Graphics: Brighten up computer graphics. Len Egol ..... Oct *201
Hazardous materials trigger a software explosion. Len Egol ..... Apr *179
—Postscripts, corrections ..... June 8
How to keep track of instruments. Walter Driedger (P.N.) ..... Apr *171
International database of environmental, health and safety regulations (C) ..... May 25
MRP II package expands materials-control capability ..... Feb *63
More, more, more software: 18 programs. Roy V. Hughson ..... Jan *157
Multiple regression: Harnessing the power of multiple regression. Dennis E. Johnson (chart, tables) ..... Nov 176
Numerical methods—CE Tutorial. Bernard Y. Tao (charts, tables, diagrams) (R)
7. Linear programming ..... July 146
PCs invade new CPI frontiers. Nicholas Basta (N) ..... Apr *43
The microprocesso. scorecard .. Apr 47
Programs for almost every problem. Len Egol June *187, ..... Aug *177
Real-time expert system for chlorine production: major project of ESPRIT (C) ..... Mar 25
Simulation and process control. Len Egol ..... Feb *161
—Letter ..... July 8
Simulation see also **Computers**—Computer models
Supercomputing for chemistry applications gets boost with two new programs (N) ..... June 62
Westinghouse computer figures out a better way to make metal tubes (N) ..... Dec 48D
Supercomputers broaden their appeal for engineering applications: ES-1 and NCUBE 2 Scalar Supercomputer (C) ..... Aug 17
Supercomputing gets a foot in the door. Nicholas Basta (N) ..... Dec *30
What's new in networking and data acquisition. Len Egol ..... Nov *269

**Concentation**
Freeze concentration will be substituted for thermal evaporation in Dairy Re-


NOTES—*Illustrated; (C) Chementator; (Ed) Editor's Page; (N) Newsfront; (P.N.) Plant Notebook; (R) Reprints available

search demonstration project (N) . Aug 56C
Juice-concentration system combining ultrafiltration and reverse osmosis (C) ..... Aug 17
Concrete—Recycled plastics could improve concrete (C) ..... Sept 25
**Construction**
Dow's European expansion plan is good news for engineering and construction firms (C) ..... Mar 19
Equipment Focus: Composites lead the way in equipment construction ... Nov *215
Materials and equipment ..... Nov 217
Manufacturers' literature ..... Nov 222
Modular construction: Deciding when to use modular construction—ACT (Advanced Construction Technology). Robert Clement (P.N.) ..... Aug *169
West Germany: Stellar year for German E & C firms. Eric Johnson (N) .... Apr 48
Containers—Storage containers stack up savings (P.N.) ..... Aug *175
**Continuous Processing**
Distributed control report: Controlling continuous processes with DCS. John C. Funk & Larry McAllister (charts). May 90
Kellogg's fully continuous aromatic-fluorine-intermediates plant, the world's first, started up by Mallinckrodt (C) ..... June 23
**Controls**
Automatic process control for pilot plants: Dow-developed product, the Camile data-acquisition and control unit (P.N.) ..... June *181
Compatibility is the buzzword on the plant floor (Ed) ..... Nov 5
Controller raises air and process capacity. Jon Pratt (P.N.) ..... Feb *151
Desktop products for process control. Len Egol ..... Dec *157
Distributed control: Batch controller helps boost output (P.N.) ..... Mar *187
Distributed control: Papermakers go electronic. Nicholas Basta (N) (charts) Mar *30
Distributed control: A primer—report May *87
Understanding distributed control. Dale R. Snyder ..... May *87
Controlling continuous processes with DCS. John C. Funk & Larry McAllister (charts) ..... May *90
DCS for batch process control. Donald J. Modell (diagrams, tables) ..... May *97
Engineering workstations improve productivity. Benjamin T. Condon (diagrams) ..... May *104
Equipment Focus: Need still higher efficiency? Look to instrumentation .. Mar *104
New equipment ..... Mar 104
Brochures and catalogs ..... Mar 112
More bits and bytes for instruments. Nicholas Basta (N) ..... Nov *46
Planning cuts the cost of retrofitting controls. Donald L. May & Donald W. Koontz (diagrams, chart) ..... Oct *181
Signal conditioners: The process-control link. Bruce Fuller (flowchart) ..... Dec 104
Simulation and process control. Len Egol ..... Feb *161
—Letter ..... July 8
**Conveyors**
Belt cooler: Get more out of your belt cooler. Per Lindén (graphs, table). Sept 170
Massflow measurement of solids in pneumatic conveying units is possible with GranuCor (C) ..... June 19
**Cooling**
Belt cooler: Get more out of your belt cooler. Per Lindén (graphs, table). Sept 170
How to predict batch-reactor heating and cooling. John McEwan (P.N.) ..... May 179
**Cooling Towers**
Equipment Focus: Cooling-water treatment—Taking the guesswork out of water treatment ..... Apr *147
Equipment and services ..... Apr 150
Evaporate and crystallize waste brines. Dennis Anthony (tables, flowchart) Apr *138
—Letters ..... July 8
For rent—portable cooling towers (C) Dec 19
Non-chromates vie for a cooling water niche. Susan Irving-Monshaw (N) . Sept *59
**Copper**
Hydrometallurgical copper-recovery process could replace smelting (C) ... Mar 21
Sandoz AG's electrochemical copper-removal process from dye-making wastes boasts savings (C) ..... Apr 17
X-ray fluoroscope helps copper platers (P.N.) ..... Apr *176
**Corrosion**
Equipment Focus: Coatings and floorings—Some handy new ways to fight corrosion ..... Mar *161
Protective-coating products ..... Mar 162
Problem-resistant flooring ..... Mar 164
Manufacturers' literature ..... Mar 169
Equipment Focus: Corrosion-resistant coatings slash maintenance costs . Dec *125
Equipment and services ..... Dec 126
Manufacturers' literature ..... Dec 133
Masonry: Inspection—Key to quality masonry lining. Walter Lee Sheppard, Jr. ..... Mar *191
Preventing corrosion in stacks and scrubbers. V.Ganapathy (P.N.) (diagrams) Jan 152
Pump wear rings: Keep the wear out of pump wear rings. Colin McCaul ... Oct *149
**Costs**
Agglomeration: Boon for solids handling. Gerald Parkinson (N) ..... Aug *37
Equipment Focus: Corrosion-resistant coatings slash maintenance costs . Dec *125
Equipment and services ..... Dec 126
Manufacturers' literature ..... Dec 133
EC's getting ready now—for 1992. Eric Johnson (N) (table) ..... Oct *30
Hazardous-waste cleanups may become more expensive in wake of court ruling involving companies responsible for oil spills (C) ..... Aug 19
Herzog-Hart's M.O.S.T. concept: A way to design and build batch fine-chemical plants cost-effectively (C) ..... Apr 17
Planning cuts the cost of retrofitting controls. Donald L. May & Donald W. Koontz (diagrams, chart) ..... Oct *181
Pollution control costs
Europe's ground-cleanup burden: Answers surface for Europe's underground woes. Eric Johnson (N) (charts) ..... June *47
People are prepared to pay more for a cleaner environment (C) ..... May 27
States face shortfall for cleaning environment (C) ..... Sept 27
U.S. businesses to boost pollution-control spending (C) ..... Sept 23
Pumps: Plagued by pumping problems? Consider the flexible-impeller pump. Don L. Watkins,Jr. (tables, graph) . Jan *94
Sizing the economic pipe. Byron D. Smith ..... Sept *201
Storage containers stack up savings (P.N.) ..... Aug *175
UC's VPSA: Gas-separation technology boasts lower costs (C) ..... Oct 17
U.K.: Privatization triggers new challenges for U.K. chemical firms. Herbert Short (N) (tables) ..... Jan *30
Waste disposal: Save money on drum-quantity waste disposal. Stephen A. Tzikas (table) ..... Feb *118
Coykendall, John of FMC—The soda ash king. Sandy Edwards ..... July *65
Creativity—How to stimulate the innovation process. Walter J. Eldredge ..... July *187
Cryogenics—Air Products' process improvements promise cheaper nitrogen (C). Dec 19
**Crystallization**
Befs crystallization process is a lower-energy, zero-discharge method of treating coke-oven wastewater (C) ..... Mar 19
Evaporate and crystallize waste brines. Dennis Anthony (tables, flowchart) Apr *138
—Letters ..... July 8
Crystals—Protein crystals grown on the Space Shuttle may lead to new drugs (C) ..... Apr 21
Cyanide—CNCProcess: cyanide is completely converted to $CO_2$ and inorganic nitrogen (C) ..... Mar 17
Czechoslovakia—Czech antipollution drive picks up speed. Eric Johnson (N) .... Oct 62

## D

Dairy Products—Freeze concentration will be substituted for thermal evaporation in Dairy Research demonstration project (N) ..... Aug 56C
**Data Communications**
Compatibility is the buzzword on the plant floor (Ed) ..... Nov 5
Distributed control: A primer—report May *87
Understanding distributed control. Dale R. Snyder ..... May *87
Controlling continuous processes with DCS. John R. Funk & Larry McAllister (charts) ..... May *90
DCS for batch process control. Donald J. Modell (diagrams, tables) ..... May *97
Engineering workstations improve productivity. Benjamin T. Condon (diagrams) ..... May *104
International database of environmental, health and safety regulations (C) . May 25
What's new in networking and data acquisition. Len Egol ..... Nov *269
**Decision Making**
Change jobs or stay put? Eugene Raudsepp (job satisfaction inventory questionnaire) ..... June *161
How to stimulate the innovation process. Walter J. Eldredge ..... July *187
**Defoaming**
Selecting chemical defoamers and antifoams. Jamie McGee (charts, table) Apr *131
Surfactants: Important tools in chemical processing. A.P. Kouloheris (diagrams, graph, tables) ..... Oct 130
Degreasing—Flush away equipment problems. Richard P. Palluzi (table, graphs, diagrams) ..... Jan *104
**Design**
Catalysts: Designer catalysts are all the rage. Gerald Parkinson & Eric Johnson (N) ..... Sept *30
—Letter ..... Dec 7
Equipment Focus: New piping systems enter the mainstream ..... May *111
Equipment and services ..... May *112
Manufacturers' literature ..... May 122
Equipment Focus: New twists in mixers and blenders ..... Jan *127
Equipment and services ..... Jan 128
Manufacturers' literature ..... Jan 134
—Postscripts, corrections ..... Mar 7
Multistage distillation: Fast analysis for multistage distillation. J.P. Tassoney (P.N.) ..... Oct 191
—Letters ..... Dec 7
Pumps: Changes in pump design can reduce seal failures. Richard Antkowiak ..... May *173
Reformer: heat-pipe reformer design may result in units that are 30% more efficient (C) ..... Apr 17
Sieve tray columns: Designing sieve tray columns. Scott D. Barnicki & James F. Davis (diagrams, tables) ..... Oct 140
Part 1: Tray design ..... Oct 141
Part 2: Column design and verification ..... Nov 203
**Desulfurization**
Austrian scheme uses flyash to remove sulfur from fluegas (C) ..... Oct 17
De-$SO_x$ process, claimed to be cheaper than conventional methods, undergoing pilot tests at Gagliri (C) ..... June 21
Fluegas desulfurization technology with half the capital, operating costs of conventional FGD systems (C) ..... Jan 21
German recycling process removes waste salts from desulfurization washwater (C) ..... Sept 21
Mist eliminators help raise sulfur-removal

NOTES—*Illustrated; (C) Chementator; (Ed) Editor's Page; (N) Newsfront; (P.N.) Plant Notebook; (R) Reprints available

capacity at Kidd Creek (P.N.) .... Nov *263
Noxso process that removes both $NO_x$ and $SO_x$ begins pilot-scale tests (C) .. June 21
Process removes up to 90% of pyritic sulfur from coal via microbubble column flotation (C) ..... July 17
Sumitomo catalyst removes more sulfur from petroleum (C) ..... Nov 17

**Dewatering**
Electroacoustic dewatering can offer energy savings (C) ..... May 23
A pressure filter for high dewatering (P.N.) ..... May *182
Surfactants: Important tools in chemical processing. A.P. Kouloheris (diagrams, graph, tables) ..... Oct 130

**Diamond Films**
Diamonds catch the CPI's eye. Jayadev Chowdhury (N) ..... Sept *48
Japan's NIRIM improves conventional deposition method (C) ..... Nov 21
UCLA process: Leveling out the rough spots on diamond films (C) ..... Nov 21
Wayne State's thermal wave technique measures thermal conductivity of diamond films (C) ..... Nov 21
Dinitrogen Pentoxide—ICI's new nitrating agent limits side reactions (C) ..... Nov 23
Disaster Control—Preparation: The key to crisis control. Roy M. Starks, Jr.... June *171
Disproportionation—Mobil R&D's disproportionation of toluene into benzene wins Kirkpatrick Honor Award (C) ..... Oct 19
Mobil selective toluene disproportionation—Kirkpatrick Honorable Mention (diagram) ..... Dec *83

**Distillation**
Air Products' process improvements promise cheaper nitrogen (C)..... Dec 19
Designing sieve tray columns. Scott D. Barnicki & James F. Davis (diagrams, tables) ..... Oct 140
Part 1: Tray design ..... Oct 141
Part 2: Column design and verification ..... Nov 203
Multistage distillation: Fast analysis for multistage distillation. J.P. Tassoney (P.N.) ..... Oct 191
—Letters ..... Dec 7
A new correlation for sieve trays. Thomas J. Ward (P.N.) (graphs)..... June 177
Synthesize simple distillation the thermodynamic way—report. David Trigueros & others (tables, diagrams) ..... Aug 129
Troubleshooting distillation columns. Mark E. Harrison & John J. France (charts, graphs, diagrams)
Part 1: Technique and tools ..... Mar *116
Part 2: Packed columns ..... Apr *121
Part 3: Trayed columns..... May *126
Part 4: Auxiliary equipment..... June *130
DNA—In vitro injection of DNA coded to produce pharmaceutical proteins in the eggs of cows (C)..... Aug 9

**Drugs**
Chiron licenses Phillips' yeast gene to make pharmaceuticals (N) ..... Oct 64
Dry seal keeps pharmaceuticals clean (P.N.) ..... June *182
Protein crystals grown on the Space Shuttle may lead to new drugs (C) .... Apr 21

**Dryers & Drying**
Equipment Focus: Dryers and evaporators ..... July *155
Equipment and services ..... July 156
Manufacturers' literature..... July 162
Industrial-dryer efficiency may be improved by an online moisture analyzer (C) ..... Aug 15
—Letter ..... Oct 8

**Dust & Fume Handling**
Baghouses: A hot and dirty future for baghouses. Gerald Parkinson (N) . Apr *30
—Postscripts, corrections..... June 8
—Letter ..... Sept 8
Duct injection may be an alternative to scrubbing in existing power plants (C) ..... Feb 23
Vortex chamber from Germany to remove fine dusts from gas streams (C) .. May 23


# E


**Economics**
Biotech sales will grow, despite...—BCC study (N) ..... Mar 64
Capital spending: Bullish plans for capital spending. Jayadev Chowdhury (N) (tables) ..... Jan 35
Capital spending by the chemical process industries will be up 20.9% (C).... July 17
Capital spending: CPI to set a new capital spending record. Jayadev Chowdhury (N) (tables)..... Aug 46
Corporate restructuring hurt R&D spending and technical employment in 1986 and 1987 (C)..... Mar 27
Energy prices will rise in the 1990s. Dennis Melamed & others (N) (chart, table) ..... Sept 55
Estimate profitability using net return rate. Thomas J. Ward (charts, diagrams) ..... Mar *151
Ethylene's riding high. Susan Irving-Monshaw & Eric Johnson (N) (charts, table) ..... May *35
Europe: Robust future for Europe's CPI. David Hunter (N)..... Jan 48F
Europe's CPI lose some steam. Herbert Short (N) ..... Feb 48B
EC: Competing for EC's 1992 pie. Eric Johnson (N) (table)..... Nov *39
Twelve nations: Twelve environmental priorities..... Nov 41
EC's getting ready now—for 1992. Eric Johnson (N) (table)..... Oct *30
German E & C firms: A stellar year. Eric Johnson (N) ..... Apr 48
OTA report lambasts Superfund work. Reginald Rhein (N) ..... Mar 58
R&D: No big surprises in Bush's R&D budget. Reginald Rhein (N) ..... Mar 50
R&D spending: U.S. corporate R&D spending continues to limp (C).... Aug 9
U.K.: Privatization triggers new challenges for U.K. chemical firms. Herbert Short (N) (tables) ..... Jan *30
U.S. CPI read the President's lips: joint SOCMA/DCMA meeting. Susan Irving-Monshaw (N)..... Mar 56
Washington prepares for 1990. Denise Kearns (N) (charts) ..... Dec 43
World Bank will pay more attention to environmental issues in its lending decisions (N)..... Nov 64

**Editor's Page**
Compatibility is the buzzword on the plant floor..... Nov 5
Conjuring up catalysts ..... Sept 5
A good credo to live by ..... Jan 5
The job market: Good news travels fast ..... Aug 5
—Letter ..... Oct 8
The Kirkpatrick Award..... Dec 5
No paper tiger ..... Mar 5
A once exclusive club ..... Feb 5
The online database explosion ..... June 5
Power to (and from) the people ..... May 5
Quality should be everybody's business ..... Oct 5
Recycling solid wastes ..... July 5
SARA's slip is showing..... Apr 5

**Education**
AIChE's instructional videotapes on chemical process safety (C)..... May 21
B.S.Ch.E. degrees awarded nosedived in 1988 (C)..... Feb 19
Continuing education: How to stay current. Stanley M. Englund (table)...Jan *143
Engineering Research Centers: The jury is still out. Reginald Rhein (N) (chart) May *41
Japan produces nearly 70% more chemical engineers than the U.S. (C) .....Jan 27

**Electricity**
Cogeneration: Power to (and from) the people (Ed)..... May 5
Cogeneration's burning bright. Jayadev Chowdhury & others (N) ..... June *39
Gas-turbine combined cycle may generate electricity more efficiently (C) .... Apr 23
German project to demonstrate alternative-energy technology (N)..... May 49
Magnetic or electric fields might improve membrane selectivity (C) ..... Aug 17
U.K.: Privatization triggers new challenges for U.K. chemical firms. Herbert Short (N) (tables) ..... Jan *30

**Electrochemical**
Electrochemical copper-removal from dyemaking wastes boasts savings at Sandoz AG (C)..... Apr 17
Electrochemical process for making fine-chemical intermediates developed by France's SNPE (N) ..... Jan 17
Making organic chemicals via electrochemical processing. Joseph E. Toomey, Jr. & Jimmy C. Yu (charts, tables, diagrams) ..... June *140
—Postscripts, corrections..... July 10
Oxidizing wastes electrochemically: U.K.'s AEA process (C)..... Sept 17
Electrocoagulation—Separating oil-water emulsions by electrocoagulation may be cheaper (N)..... Jan 19
Electrolysis—Making organic chemicals via electrochemical processing. Joseph E. Toomey, Jr. & Jimmy C. Yu (charts, tables, diagrams)..... June *140
—Postscripts, corrections..... July 10
Electron Beams—Combustion Engineering developing way to eliminate $SO_2$ via radiation with high-energy electrons (C) . Feb 25

**Electronics**
Electronic chemicals' market (N) .. June 66F
Equipment Focus: Electronics aid bulk materials handling..... Sept *179
Manufacturers' literature..... Sept 189
—Letter ..... Nov 8
Papermakers go electronic. Nicholas Basta (N) (charts) ..... Mar *30
—Postscripts, corrections..... June 8
Signal conditioners: The process-control link. Bruce Fuller (flowchart)..... Dec 104
Electroplating—Evaporator keeps plating solutions on target (P.N.)..... July *178
Electrostatics—Electrostatic device agglomerates small particulates (C) ..... Sept 19

**Employment**
Ch.E.s are back in high demand .... Aug *22
Good times have returned to the employment scene in the U.S. Nicholas Basta (N) (chart, table) ..... Aug *22
Europe, there are going to be more jobs than available graduates. Eric Johnson (N) (charts)..... Aug *23
Corporate restructuring hurt technical employment in 1986 and 1987 (N) . Mar 27
Demand for engineers remains weak (C) ..... Sept 17
—Letter ..... Dec 7
EC: Competing for EC's 1992 pie. Eric Johnson (N) (table)..... Nov *39
The job market: Good news travels fast (Ed) ..... Aug 5
—Letter ..... Oct 8
The total system of job search. Kenneth & Sheryl Dawson
Part 1: Résumés ..... Apr *158
Part 2: Reference-building, networking, interviewing, negotiating ..... May *165
Women engineers: The playing field isn't level. Suzanne Shelley (N) ..... Dec *47
Emulsification—Surfactants: Important tools in chemical processing. A.P. Kouloheris (diagrams, graph, tables) ..... Oct 130

**Energy**
American Iron & Steel Institute process may make energy savings of about 20% possible via direct steelmaking (C) June 23
DOE: James Watkins is President Bush's choice to head DOE (N) ..... Feb 27
DOE's nuclear cleanup plan shunned by EPA (C) ..... Sept 27
DOE starts work on a national energy policy (C) ..... Aug 19
Dow Chemical forming Destec Energy, Inc. (N)..... June 58
Electroacoustic dewatering can offer energy savings (C)..... May 23


NOTES—*Illustrated; (C) Chementator; (Ed) Editor's Page; (N) Newsfront; (P.N.) Plant Notebook; (R) Reprints available

German project to demonstrate alternative-energy technology (N) ..... May 49
Prices: Energy prices will rise in the 1990s. Dennis Melamed & others (N) (chart, table) ..... Sept 55
Energy See also **Fuel**; specific fuel
**Engineering**
Dow's European expansion plan is good news for engineering and construction firms (C) ..... Mar 19
Engineering Research Centers: The jury is still out. Reginald Rhein (N) (chart) May *41
Sovitex, joint venture between Italian and Soviet engineering firms (N) .... June 66H
West Germany: Stellar year for German E & C firms. Eric Johnson (N) .... Apr 48
**Engineers**
Desktop publishing: For dressing up engineers' reports. Len Egol ..... May *185
Education see **Education**
Employment see **Employment**
Japan produces nearly 70% more chemical engineers than the U.S. (C) ..... Jan 27
Salaries see **Salaries**
Women engineers: The playing field isn't level. Suzanne Shelley ..... Dec *47
You and Your Job articles see **You & Your Job**
**Environment**
Catalysts: Designer catalysts are all the rage. Gerald Parkinson & Eric Johnson (N) ..... Sept *30
—Letter ..... Dec 7
City of Torrance, Calif. takes legal action to have Mobil Oil refinery declared a public nuisance (C) ..... May 23
Congress (101st) taking up environmental bills (C) ..... Feb 27
Czech antipollution drive picks up speed. Eric Johnson (N) ..... Oct 62
Dow Chemical will get the World Environment Center's 1989 Gold Medal (C) Jan 19
Environmental Issues in the Year 2000: Forum seeks answers to global pollution woes. Gerald Parkinson (N) ..... Feb 48B
Equipment Focus: Clean outlook for solids handling ..... Nov *163
Manufacturers' literature ..... Nov 171
Europe-wide environmental agency proposed by the EC (C) ..... Aug 19
EC: Competing for EC's 1992 pie. Eric Johnson (N) (table) ..... Nov *39
Twelve nations: Twelve environmental priorities ..... Nov 41
Greenpeace targets West German CFC producers (C) ..... Oct 23
Inhalation of refractory ceramic fibers may pose a health hazard (C) ..... Apr 25
International database of environmental, health and safety regulations (C) . May 25
NIST database adds more than 6,000 new mass spectra (N) ..... Feb 48F
OMB allegedly stalls environmental, safety regulations (C) ..... Dec 25
Paper mill study: No paper tiger (Ed) Mar 5
Paper mill study: Dioxin found in fish and wastewater downstream from paper mills (C) ..... Apr 27
Pollution control costs
Europe's ground-cleanup burden: Answers surface for Europe's underground woes. Eric Johnson (N) (charts) ..... June *47
People are prepared to pay more for a cleaner environment (C) ..... May 27
States face shortfall for cleaning environment (C) ..... Sept 27
U.S. businesses to boost pollution-control spending (C) ..... Sept 23
Pollution control market in Europe (N) ..... May 48
Pumps: Surging interest in leakproof pumps. Gerald Parkinson & Eric Johnson (N) (diagram) ..... June *30
Choices widen for magnetically driven pumps ..... June 35
—Letter ..... Aug 7
—Postscripts, corrections ..... Oct 8
$TiO_2$'s future is keyed to new technologies. Lisa Lazorko & others (N) (tables) Jan *37
U.S. CPI read the President's lips: joint SOCMA/DCMA meeting. Susan Irving-Monshaw (N) ..... Mar 56
U.S. consumers are turning 'green': survey finds The Nineties will be the decade of products with a strong environmental perspective (C) ..... Oct 19
Washington prepares for 1990. Denise Kearns (N) (charts) ..... Dec 43
World Bank will pay more attention to environmental issues in its lending decisions (N) ..... Nov 64
Environment See also **Air Pollution; Noise Pollution; Waste Disposal; Water Pollution**
**Environmental Protection Agency**
Benzene emissions to be cut by 90% (C) Oct 25
Biotechnology regulations to be proposed under TSCA (C) ..... Jan 27
Bush nominates William Reilly to head EPA (C) ..... Jan 25
Clean Water Act see **Law**—Clean Water Act
Pesticide regulations
EPA cancels pesticides permits and proposes a new policy (C) ..... Dec 25
Pollution Prevention Office established (C) ..... Feb 27
SARA's slip is showing (Ed) ..... Apr 5
Waste disposal: EPA adds to restrictions on hazardous-waste disposal (C) .. Dec 27
Enzymes—Catalysts: Designer catalysts are all the rage. Gerald Parkinson & Eric Johnson (N) ..... Sept *30
—Letter ..... Dec 7
**Equipment**
Achemasia invests in the future. Richard Zanetti (N) ..... Nov *58
Chem Show '89 see **Chem Show '89**
Confessions of a service engineer. George R. Kent
Part I: Troubleshooting vibration problems ..... Feb *145
Part II: Troubleshooting rotating equipment ..... Apr *165
Part III: Troubleshooting equipment vibration ..... July *171
Flush away equipment problems. Richard P. Palluzi (table, graphs, diagrams) Jan *104
How good are CPI products? (survey including questionnaire) ..... Apr *92
Readers rate CPI products (survey results). Nicholas Basta & Jayadev Chowdhury (charts, tables) ..... Oct *104
ISA conference and exhibition preview: Philly hosts ISA/89 ..... Sept *97
ISA show highlights ..... Sept *99
Petro Expo '89 Preview ..... Mar *85
Powder & Bulk Solids Conference & Exhibition—Preview: New product highlights ..... Apr *71
Quality should be everybody's business (Ed) ..... Oct 5
A reliable base for high-nickel equipment. James L. Gossett (tables) ..... May *145
Shrinking CPI equipment—no small feat: micromachining. Jayadev Chowdhury (N) ..... May *31
**Equipment Focus**
Bulk materials handling: Electronics aid bulk materials handling ..... Sept *179
Manufacturers' literature ..... Sept 189
—Letter ..... Nov 8
Coatings and floorings: Some handy new ways to fight corrosion ..... Mar *161
Protective-coating products ..... Mar 162
Problem-resistant flooring ..... Mar 164
Manufacturers' literature ..... Mar 169
Coatings: Corrosion-resistant coatings slash maintenance costs ..... Dec *125
Equipment and services ..... Dec 126
Manufacturers' literature ..... Dec 133
Composites lead the way in equipment construction ..... Nov *215
Materials and equipment ..... Nov 217
Manufacturers' literature ..... Nov 222
Computer software: The expanding world of computer software ..... Aug *113
Equipment and services ..... Aug 113
Cooling-water treatment: Taking the guesswork out of water treatment Apr *147
Equipment and services ..... Apr 150
Dryers and evaporators ..... July *155
Equipment and services ..... July 156
Manufacturers' literature ..... July 162
Flowmeters: Back to basics ..... Aug *137
Equipment and services ..... Aug 137
Manufacturers' information ..... Aug 144
Instrumentation: Need still higher efficiency? Look to instrumentation .. Mar *104
New equipment ..... Mar 104
Brochures and catalogs ..... Mar 112
Insulation products save human energy ..... Feb *127
Equipment and services ..... Feb *129
Manufacturers' literature ..... Feb 132
Mixers and blenders: New twists in mixers and blenders ..... Jan *127
Equipment and services ..... Jan 128
Manufacturers' literature ..... Jan 134
—Postscripts, corrections ..... Mar 7
Mixers: A variety of equipment for varied services ..... July *115
Manufacturers' literature ..... July 119
Pipes and fittings: New piping systems enter the mainstream ..... May *111
Equipment and services ..... May *112
Manufacturers' literature ..... May 122
Pumps: New pumps offer greater versatility ..... Feb *83
Equipment and services ..... Feb *83
Pumps leak less, last longer in severe service ..... Oct *159
Manufacturers literature ..... Oct 167
Safety is job one ..... Apr *107
Equipment and services ..... Apr 107
Manufacturers' literature ..... Apr 114
Seals and packings ..... June *99
Equipment and services ..... June *99
Bigger and better seals and bearings handle diverse applications .... June *101
Solid-liquid separations: Broader options enhance solid-liquid separations . June *151
Equipment and services ..... June *151
Manufacturers' literature ..... June 158
Solids handling: Clean outlook for solids handling ..... Nov *163
Manufacturers' literature ..... Nov 171
Steam traps ..... Oct *117
Manufacturers' literature ..... Oct 122
Valves: Spotlighting valves ..... Jan *71
Equipment and services ..... Jan *71
Manufacturers' literature ..... Jan 76
Valves seek higher performance levels ..... May *153
Product developments ..... May *154
Manufacturers' literature ..... May 162
Valves: Small equipment that adds up to a big investment ..... Sept *133
Manufacturers' information ..... Sept 142
Water and wastewater treatment: A thriving business ..... Dec *85
Equipment and services ..... Dec 86
**Ethylene**
Amoco Chemical will build ethylene facility near Chocolate Bayou, Tex. (C) Feb 19
Ethylene's riding high. Susan Irving-Monshaw & Eric Johnson (N) (charts, table) ..... May *35
Olefins-separation process offers lower costs and higher capacities for ethylene plants (C) ..... Aug 15
U.S. ethylene consumption (N) ..... Oct 68E
**Ethylene Oxide**
Process to recover CFCs from ethylene oxide sterilant (C) ..... Jan 23
Scrubber eliminates ethylene oxide (P.N.) ..... Dec *153
Ethylene-Vinyl-Alcohol—Du Pont will build the world's largest ethylene-vinyl-alcohol resins plant (C) ..... Jan 17
**Europe**
Aspen hits Europe (N) ..... Jan 48H
—Letter ..... Apr 7
Ch.E.s are back in high demand: Europe, there are going to be more jobs than available graduates. Eric Johnson (N) (charts) ..... Aug *23
CPI lose some steam. Herb Short (N) Feb 48B
Dow's European expansion plan is good


NOTES—*Illustrated; (C) Chementator; (Ed) Editor's Page; (N) Newsfront; (P.N.) Plant Notebook; (R) Reprints available

news for engineering and construction firms (C) ... Mar 19
EPO signs three companies to develop an online service called Epoque (N) . June 58
ESPRIT project: real-time expert system for chlorine production (C) ... Mar 25
Europe-wide environmental agency proposed by the EC (C) ... Aug 19
EC: Competing for EC's 1992 pie. Eric Johnson (N) (table) ... Nov *39
Twelve nations: Twelve environmental priorities ... Nov 41
EC's getting ready now—for 1992. Eric Johnson (N) (table) ... Oct *30
Ground cleanup: Answers surface for Europe's underground woes. Eric Johnson (N) (charts) ... June *47
Market for pollution control (N) ... May 48
Research programs (3) closely related to CPI activities approved for funding (N) ... June 66E
Robust future for Europe's CPI. David Hunter (N) ... Jan 48F

**Evaporation**
Evaporate and crystallize waste brines. Dennis Anthony (tables, flowchart) Apr *138
—Letters ... July 8

**Evaporators**
Equipment Focus: Dryers and evaporators ... July *155
Equipment and services ... July 156
Manufacturers' literature ... July 162
Evaporator keeps plating solutions on target (P.N.) ... July *178
Triple-effect evaporator aids in byproduct recovery at Jack Daniel Distillery (P.N.) (flowchart) ... Nov *259
Explosions—Phillips' explosion and fire wipes out 15-20% of U.S. HDPE capacity (C) ... Nov 17
Explosives—Fingerprinting explosives—Letter ... Feb 7
—Letter ... Aug 7

**Exports**
Chemical-weapons furor pricks the CPI: illegal exports by West German firms. Eric Johnson (N) ... Mar 47
EC: Competing for EC's 1992 pie. Eric Johnson (N) (table) ... Nov *39
EC's getting ready now—for 1992. Eric Johnson (N) (table) ... Oct *30
Hazardous waste: International pact governing the import and export of hazardous wastes expected to get U.S. approval (C) ... July 27
International shipments of hazardous wastes: Keeping tabs on the world's wastes. Eric Johnson (N) ... Apr 48E

**Extraction**
Liquefied-gas solvent-extraction process for waste treatment (C) ... July 19
Membranes can save energy in extracting water vapor from air streams (C) . Dec 21
Salt-purification system with one-fourth the energy costs is solvent-extraction route (C) ... Aug 9
Supercritical fluid extraction scaleup will be simplified (C) ... Mar 17
Supercritical processes win CPI acceptance. Gerald Parkinson & Eric Johnson (N) ... July *35
Extrusion—Plastics: From pellets to products. Dale E. Witwer (diagrams) ... Sept *123

# F

Fermentation—ICI PLC will build fermentation and harvesting facility (N) ... Feb 48F
Fertilizers—German route converts liquefied dung to environmentally acceptable fertil izer (C) ... Apr 23
Fertilizers See also specific fertilizer

**Fibers**
Aramids: A first look at aramid processing—Akzo's multistep process for making aramid fibers. Herbert Short (N) (flowchart) ... Apr *37
Demand soon to meet up with capacity ... Apr 40
Baghouses: A hot and dirty future for baghouses. Gerald Parkinson (N) . Apr *30
—Postscripts, corrections ... June 8
—Letter ... Sept 8
Ceramic fibers made by laser-based chemical-vapor-deposition process (C) ... July 17
DSM eyes new polymer markets: plans Dyneema, PE fiber, plant (N) ... Jan 48H
Inhalation of refractory ceramic fibers may pose a health hazard (C) ... Apr 25
"ROW" spurs growth in manmade fibers. Eric Johnson (N) ... Mar 64E
Filtech Europa '89 Conference—New product highlights ... Aug *88

**Filters & Filtration**
Alcan reports improved iron-oxide removal from alumina by activated-sand filters (C) ... Mar 23
Baghouses: A hot and dirty future for baghouses. Gerald Parkinson (N) . Apr *30
—Postscripts, corrections ... June 8
—Letter ... Sept 8
Crossflow microfilters: The ins and outs—report. Stephen L. Michaels (diagrams, tables) ... Jan *84
—Letters ... July 8
Filtech Europa '89 Conference: new product highlights ... Aug *88
Juice-concentration system combining ultrafiltration and reverse osmosis (C) Aug 17
Mist eliminators help raise sulfur-removal capacity at Kidd Creek (P.N.) ... Nov *263
A pressure filter for high dewatering (P.N.) ... May *182
Fine Chemicals—Herzog-Hart's M.O.S.T. concept: A way to design and build batch fine-chemical plants cost-effectively (C) ... Apr 17
Fire Protection—Fire modeling: Hazard I (N) ... Oct 64
Fires—Phillips' explosion and fire wipes out 15-20% of U.S. HDPE capacity (C) .. Nov 17
Flocculants—American Cyanamid developing flocculant for alumina production that offers better process-liquor clarity (C) ... Mar 23
Floors & Flooring—Equipment Focus: Coatings and floorings—Some handy new ways to fight corrosion ... Mar *161
Protective-coating products ... Mar 162
Problem-resistant flooring ... Mar 164
Manufacturers' literature ... Mar 169
Flotation—Process removes up to 90% of pyritic sulfur from coal via microbubble column flotation (C) ... July 17

**Flow**
Massflow measurement of solids in pneumatic conveying units is possible with GranuCor (C) ... June 19
Sizing the economic pipe. Byron D. Smith ... Sept *201
Flowmeters—Equipment Focus: Flowmeters: Back to basics ... Aug *137
Equipment and services ... Aug 137
Manufacturers' information ... Aug 144

**Fluids**
Heat-transfer fluid solves coking problems (P.N.) ... Sept *215
Heat-transfer fluids: Get fluent about heat transfer fluids—report (charts, tables, graphs) ... Feb *90
The heat-transfer-fluid spectrum. Richard L. Green & others ... Feb *90
Matching the fluid with the process. W.F. Seifert ... Feb 99
Heat transfer perks up with new fluids. Gerald Parkinson (N) ... Feb *39
Sizing the economic pipe. Byron D. Smith ... Sept *201
Supercritical-fluid chromatography could cut solvent costs five-to-ten-fold (C) Mar 17
Supercritical fluid extraction scaleup will be simplified (C) ... Mar 17
Supercritical processes win CPI acceptance. Gerald Parkinson & Eric Johnson (N) ... July *35
Fluorine—Kellogg's fully continuous aromatic-fluorine-intermediates plant, the world's first, started up by Mallinckrodt (C) ... June 23

**Flyash**
Austrian scheme uses flyash to remove sulfur from fluegas (C) ... Oct 17
Flyash can make clay landfill-liners better barriers to organic contaminants (C) Aug 17
Heavy-metals-laden flyash can be landfilled after stabilization by a process that will debut in Switzerland (C) June 19

**Foam**
'Foam scrubbing' may control toxic-gas releases (C) ... Sept 17
Selecting chemical defoamers and antifoams. Jamie McGee (charts, table) Apr *131

**Food**
Electroacoustic dewatering can offer energy savings of about 30% to food processors (C) ... May 23
Fat replacers: Eat and stay thin (C) . Nov 25
Food processing: Supercritical processes win CPI acceptance. Gerald Parkinson & Eric Johnson (N) ... July *35
Freeze concentration will be substituted for thermal evaporation in Dairy Research demonstration project (N) . Aug 56C
Meat: More-efficient meat processing (N) ... Sept 69
USDA developing edible, transparent coatings: goal of research program is sliced frutis and vegetables that stay fresh for at least a week (C) ... May 21
Forming—Plastics: From pellets to products. Dale E. Witwer (diagrams) ... Sept *123

**France**
Befs crystallization process is a lower-energy, zero-discharge method of treating coke-oven wastewater (C) ... Mar 19
Electrochemical process for making fine-chemical intermediates developed by SNPE (C) ... Jan 17
Supercritical-fluid chromatography could cut solvent costs five-to-ten-fold (C) Mar 17
Freezing—Freeze concentration will be substituted for thermal evaporation in Dairy Research demonstration project (N) . Aug 56C
Fruit Juice—Juice-concentration system combining ultrafiltration and reverse osmosis (C) ... Aug 17

**Fuel**
Additive that lowers an engine's octane need by about 70%, cuts hydrocarbon emissions and improves fuel economy announced (C) ... Jan 17
—Postscripts, corrections ... Mar 7
Alternative fuels: Bush Administration ponders new alternative-fuels program (C) ... Dec 27
Alternative fuels: Is gasoline an alternative fuel? (N) ... Aug 56G
Automotive: Clean Air battle heats up over alternative fuels for vehicles (C) .. Nov 27
Automotive: Methanol—too expensive for auto fuel? (C) ... Dec 21
Automotive: U.S. industry group to test cleaner auto fuels (C) ... Nov 21
California:California diesel fuel gets stricter standards. Gerald Parkinson (N) Jan 42
SCAQMD to vote on plan to phase out the use of petroleum-derived and solid fossil fuels (C) ... Feb 25
Seeking clear skies in California (N) Aug 35
Southern California's clean-air plan gets the green light (C) ... Sept 25
Diesel fuel: a new source of drinking water (C) ... Dec 21
Garbage plant makes fuel instead of landfill fodder (C) ... Nov 19
Gas-turbine combined cycle may generate electricity more efficiently (C) .... Apr 23
High-energy fuel see **High-Energy Fuel**
Oilfield waste can be converted to a clean fuel via gasification (C) ... Apr 23
Sludge-to-fuel process competes with landfilling in W. Germany (C) ... Nov 19
Fuel Cells—New fuel cells are sparking interest. Gerald Parkinson (N) ... Aug 48

**Furnaces**
Electric-arc furnace to test ash-minimization process (C) ... Oct 17

NOTES—*Illustrated; (C) Chementator; (Ed) Editor's Page; (N) Newsfront; (P.N.) Plant Notebook; (R) Reprints available

A just-patented conveyor furnace for waste treatment is more cost-effective (C) ..... Apr 21

## G

Gages—Vacuum gages: Select the right vacuum gage. D.L. Roper & J.L. Ryans (charts, tables, nomograph, diagrams) Mar *125
Gallium—South Africa: process to recover gallium from ore dusts being tried out (C) ..... Feb 19

**Gas**
Greenhouse gases: international movement to regulate emissions (N) ... Aug 56
Membranes can save energy in gas cleanup (C) ..... Dec 21
Predict safe oxygen in combustible gases. T.K. Subramaniam & Joseph V. Cangelosi ..... Dec 108
Correction ..... Jan 1990 8
Solvent unit cleans synthesis gas. R.J. Hernandez & T.L. Huurdeman (P.N.) (tables) ..... Feb 154
Gas See also specific gas

**Gasification**
Carbonaceous wastes can be gasified without environmental problems with Skygas process (C) ..... July 21
DOE asks for "expressions of interest" in building a medium-Btu biomass gasifier (C) ..... Jan 21
Oilfield waste can be converted to a clean fuel via gasification (C) ..... Apr 23
Pulse combustion gets a big tryout at pulp mill. Gerald Parkinson (N) ..... July 51
Shell's coal-gasification process will get its first commercial-scale tryout in Netherlands plant (C) ..... July 17

**Gasoline**
Additive that lowers an engine's octane need by about 70%, cuts hydrocarbon emissions and improves fuel economy announced (C) ..... Jan 17
—Postscripts, corrections ..... Mar 7
Alternative fuels: Is gasoline an alternative fuel? (N) ..... Aug 56G
ARCO's new gasoline reduces emissions (C) ..... Sept 25
Summer volatility rules for gasoline require lowering Reid Vapor Pressure (C) ..... Apr 27
Gaumer, Lee of Air Products and Chemicals—Nurturing our best. Sandy Edwards ..... Nov *71

**Generators**
Cogeneration: Power to (and from) the people (Ed) ..... May 5
Cogeneration's burning bright. Jayadev Chowdhury & others (N) ..... June *39
Russians generating electric power with small size windmills (N) ..... Dec 48D

**Genetic Engineering**
Biotechnology regulation, testing etc. see **Biotechnology**
Genetics still not in the legal code: West German court revokes Hoechst permit to build a plant that would use genetically-altered organisms to make human insulin (C) ..... Dec 23
In vitro injection of DNA coded to produce pharmaceutical proteins in the eggs of cows (C) ..... Aug 9
West German biotech-permit battle erupts over BASF plans to build pilot unit that would use genetically engineered bacteria (C) ..... July 25
BASF fights for its anti-cancer agent (C) ..... Oct 25
Geothermal—Italy's Latera plant: Geothermal energy gets a lift. Gerald Parkinson (N) ..... Mar 54

**Germany, West**
BASF complex will get its own gas pipeline (C) ..... Dec 19
Bayer-Sulzer-Escher Wyss patent battle over sulfuric acid-recycle process (N) Jan 39, (C) ..... Apr 23
—Letter ..... May 7
Biotech-permit battle erupts over BASF plans to build pilot unit that would use genetically engineered bacteria (C) July 25
BASF fights for its anti-cancer agent (C) ..... Oct 25
Building material can be made from waste gypsum (C) ..... Aug 13
Chemical-weapons furor over illegal exports pricks the CPI. Eric Johnson (N) ..... Mar 47
Coal ash may offset acid rain damage: new compound (C) ..... Dec 19
First commercial LLDPE plant using BASF technology construction to begin (C) ..... Apr 21
First commercial use of absorption in a solvent-recovery application (C) ... Mar 17
Genetics still not in the legal code: court revokes Hoechst permit to build a plant that would use genetically-altered organisms to make human insulin (C) Dec 23
Greenpeace targets CFC producers (C) ..... Oct 23
Liquefied dung converted to environmentally acceptable fertilizer by new route (C) ..... Apr 23
Nitrate wastewater emissions from steel pickling are eliminated by recycling process (C) ..... Aug 15
Preussag process cuts waste-sludge volume from ore leaching by about 80% (C) ..... Aug 11
Process that could clean up chlorinated wastes at 1/3 to 1/2 the cost of incineration will debut in mobile unit (C) .. Feb 17
Project to demonstrate alternative-energy technology (N) ..... May 49
Recycling process removes waste salts from desulfurization washwater (C) Sept 21
"ROW" spurs growth in manmade fibers. Eric Johnson (N) ..... Mar 64E
Route for removing $SO_2$ after calcining of $TiO_2$ creates no added wastes (C) . May 21
Sludge-to-fuel process competes with landfilling (C) ..... Nov 19
Stellar year for German E & C firms. Eric Johnson (N) ..... Apr 48
Vortex chamber to remove fine dusts from gas streams (C) ..... May 23
West German plastics producers report record year in 1988 (N) ..... June 62
Glass Fibers—Baghouses: A hot and dirty future for baghouses. Gerald Parkinson (N) ..... Apr *30
—Postscripts, corrections ..... June 8
Glyoxylic Acid—Chemie Linz route yields higher-purity glyoxylic acid and no wastewater (C) ..... Mar 21
Gold—Giant Bay Resources completes bioleach tests of gold (N) ..... June 66F
Graphite—USBM's process could produce graphite flake at a fraction of the current cost (C) ..... June 17

**Great Britain**
ICI's new nitrating agent limits side reactions (C) ..... Nov 23
ICI PLC will build fermentation and harvesting facility (N) ..... Feb 48F
Molecular-sieve system for capturing fugitive emissions will be pilot tested (C) Feb 19
$NH_3$ break thru: Small plants; ICI's Leading Concept Ammonia process. Herb Short (N) (flowchart) ..... July *41
Oxidizing wastes electrochemically: U.K.'s AEA process (C) ..... Sept 17
Privatization triggers new challenges for U.K. chemical firms. Herbert Short (N) (tables) ..... Jan *30
Gypsum—Building material can be made from waste gypsum in new German route (C) ..... Aug 13

## H

**Health**
Inhalation of refractory ceramic fibers may pose a health hazard (C) ..... Apr 25
International database of environmental, health and safety regulations (C) . May 25

**Heat Exchangers**
Getting top performance from heat exchangers. David F. Fijas (tables) . Dec *141
Modeling-help wanted—Letter ..... Jan 7
Norsk Hydro will pilot test new heat exchanger that is small, but keeps its cool (C) ..... Dec 17
Spiral heat exchanger resists clogging (P.N.) ..... June *184
Thermoplastic heat exchangers offering lower maintenance costs (C) ..... Apr 19

**Heat Transfer**
Get fluent about heat transfer fluids—report (charts, tables, graphs) .... Feb 90
The heat-transfer-fluid spectrum. Richard L. Green & others ..... Feb 90
Matching the fluid with the process. W.F. Seifert ..... Feb 99
Heat-transfer fluid solves coking problems (P.N.) ..... Sept *215
Heat transfer perks up with new fluids. Gerald Parkinson (N) ..... Feb *39
How to predict batch-reactor heating and cooling. John McEwan (P.N.) ..... May 179
Inserts that improve tubeside heat transfer up to five times in gas streams (C) ..... Jan 17
Heat Treating—UCLA developing heat treatment technique that could result in stronger plastics (C) ..... June 21
Heaters & Heating—Fired heaters: How to boost the performance of fired heaters. A. Garg (tables, chart, diagrams) ..... Nov 239
Humidity—Compute relative humidity *quickly*. P.H. Pallady (P.N.) ..... Nov 255
Hunt, Charles of Ethyl—Managing the 'model' plant. Sandy Edwards ..... Sept *79
—Letter ..... Dec 7

**Hydrocarbons**
Diamonds catch the CPI's eye. Jayadev Chowdhury (N) ..... Sept *48
How to predict *n*-alkane densities. Charles H. Fisher (P.N.) ..... Oct 195
Hydrocarbons can be converted to industrial alcohol in a single step with catalysts developed at Univ. of Calif. (C) May 17
Hydrofluoric Acid—Finding the properties of hydrofluoric acid. José Vincente Gómez (P.N.) (table) ..... Feb 152
—Postscripts, corrections ..... June 8
Hydrogen—Silberring looking for a hydrogen user to demonstrate a novel steam reformer (C) ..... Feb 17

**Hydrogenation**
Direct contact hydrogenation route, new way to detoxify liquid organic waste, proposed for central hazardous-waste-treatment facility in the Netherlands (C) ..... Aug 11
Shell Nederland hydrogenation process uses a continuous circulating catalyst (N) ..... Aug 56G

## I

Ideas—How to stimulate the innovation process. Walter J. Eldredge ..... July *187

**Imports**
Dumping
Japanese firms charged with dumping pipe products in the U.S. (N) June 66H
EC: Competing for EC's 1992 pie. Eric Johnson (N) (table) ..... Nov *39
EC's getting ready now—for 1992. Eric Johnson (N) (table) ..... Oct *30
Hazardous wastes: International pact governing the import and export of hazardous wastes expected to get U.S. approval (C) ..... July 27
International shipments of hazardous wastes: Keeping tabs on the world's wastes. Eric Johnson (N) ..... Apr 48E
Oil: U.S. oil imports are expected to increase (C) ..... Sept 27

**Incineration**
Austrian scheme uses flyash to remove sulfur from fluegas (C) ..... Oct 17
California's first fixed, commercial hazardous-waste incinerator bogged down

NOTES—*Illustrated; (C) Chementator; (Ed) Editor's Page; (N) Newsfront; (P.N.) Plant Notebook; (R) Reprints available

in permitting process (C) ..... Jan 25
Circulating-bed combustion system being evaluated to clean up McColl Superfund site in Calif. (C) ..... Jan 23
DOE's INEL begins first full-scale incineration of nuclear and non-nuclear mixed wastes (C) ..... Mar 19
HDCs: new catalysts destroy volatile organics at lower incineration temperatures (C) ..... July 19
O.H. Materials granted a permit for a mobile infrared incinerator (C) ... Feb 21
UC technology for use of oxygen-enhanced combustion in mobile hazardous-waste incinerators wins 1989 Kirkpatrick Award (C) ..... Oct 19
UC's novel oxygen-enhanced combustion of hazardous wastes wins 1989 Kirkpatrick Chemical Engineering Achievement Award ..... Dec *79
Zepp System's novel incinerator design uses no refractory (C) ..... Oct 19
India—Bhopal tragedy: UC will pay $470 million to settle litigation (C) ..... Mar 25

**Information Retrieval**
ASME Boiler and Pressure Vessel Code is going electronic (C) ..... May 19
Databases: A wealth of information online—report. Nicholas P. Chopey & others ..... June *112
—Postscripts, corrections July 10, Aug 7
—Letters Sept-8, ..... Dec 7
EPO signs three companies to develop an online service called Epoque (N) . June 58
How to keep track of instruments. Walter Driedger (P.N.) ..... Apr *171
International database of environmental, health and safety regulations (C) . May 25
NIST computerized database contains data on chemical reaction rates (C) ..... June 23
NIST database adds more than 6,000 new mass spectra (N) ..... Feb 48F
The online database explosion (Ed). June 5
What's new in networking and data acquisition. Len Egol ..... Nov *269
Infrared—O.H. Materials granted a permit for a mobile infrared incinerator (C) Feb 21
Insecticides see **Pesticides**
Inspection—Inspection: Key to quality masonry lining. Walter Lee Sheppard, Jr. Mar *191
Instrument Society of America—Philly hosts ISA/89: conference and exhibition preview ..... Sept *97
ISA show highlights ..... Sept *99

**Instruments**
Analyzers: Portable waste analyzer gives immediate results (C) ..... Oct 19
Compatibility is the buzzword on the plant floor (Ed) ..... Nov 5
Control components: More bits and bytes for instruments. Nicholas Basta (N) Nov *46
Equipment Focus: Electronics aid bulk materials handling ..... Sept *179
Manufacturers' literature ..... Sept 189
—Letter ..... Nov 8
Equipment Focus: Need still higher efficiency? Look to instrumentation .. Mar *104
New equipment ..... Mar 104
Brochures and catalogs ..... Mar 112
How to keep track of instruments. Walter Driedger (P.N.) ..... Apr *171
ISA conference and exhibition preview: Philly hosts ISA/89 ..... Sept *97
ISA show highlights ..... Sept *99
Planning cuts the cost of retrofitting controls. Donald L. May & Donald W. Koontz (diagrams, chart) ..... Oct *181
Shrinking CPI equipment—no small feat: micromachining. Jayadev Chowdhury (N) ..... May *31
Waste-site analyses can be cut from days to minutes with Los Alamos National Lab portable instrument (C) ..... Mar 21

**Insulation**
Calculate insulation thickness for personnel protection. Win Irwin (P.N.) (table) ..... Sept *207
Equipment Focus: Insulation products save human energy ..... Feb *127
Equipment and services ..... Feb *129
Manufacturers' literature ..... Feb 132
Lightweight insulation for refrigeration (N) ..... Aug 56
Insurance—Superfund money should come from surcharges on insurance premiums (C) ..... Mar 27

**Intermediates**
Electrochemical process for making fine-chemical intermediates developed by France's SNPE (C) ..... Jan 17
Kellogg's fully continuous aromatic-fluorine-intermediates plant, the world's first, started up by Mallinckrodt (C) ..... June 23
Ion Exchange—Uniform-sized ion-exchange resins from Dow are stronger and last longer (C) ..... Nov 17

**Italy**
De-$SO_x$ process, claimed to be cheaper than conventional methods, undergoing pilot tests at Gagliri (C) ..... June 21
Enimont will soon become a reality (N) Jan 48D
Geothermal energy gets a lift: Latera plant. Gerald Parkinson (N) ..... Mar 54
Recycling salt slag from aluminum manufacturing (C) ..... Sept 23
Sovitex, joint venture between Italian and Soviet engineering firms (N) .... June 66H

## J

**Japan**
Degradable plastics from polysaccharides (C) ..... Sept 19
Engineers: Japan produces nearly 70% more chemical engineers than the U.S. (C) ..... Jan 27
KRI will issue interpretive studies of Japanese technical developments (N) . June 60
Mitsubishi building semicommercial plant for producing 2,6-naphthalene dicarboxylic acid (C) ..... July 23
Mitsubishi will try out new route for methyl methacrylate (C) ..... July 23
Mitsui to commercialize a high-temperature superconductor (C) ..... Nov 21
NIRIM improves conventional deposition method (C) ..... Nov 21
Polymer sinter, Porosoft, has novel absorption properties (C) ..... Oct 25
STG charges Japanese firms with dumping pipe products in the U.S. (N). June 66H
Sumitomo catalyst removes more sulfur from petroleum (C) ..... Nov 17
Superbugs Project
Bacterium thrives on chemical solvents (C) ..... Oct 21
Producing magnetic particles in bacteria (C) ..... Oct 23
Vacuum pump features ceramic rotor assembly (C) ..... Oct 17

## K

Kavasmaneck, Percy of Union Carbide—Don't burn the toast. Sandy Edwards Mar *69
Kuwait—Process for treating hot effluents—45-75°C, vs.25-35°C for methods using conventional microorganisms will be tested (C) ..... July 19

## L

**Labor**
Milliken Chemical's operator-self-managed process plant is a success (C) ..... Jan 25
OSHA
Exposure limits for 428 toxic substances become effective Mar. 1 (C) .... Feb 27
Hazard Communication Standard: Supreme Court to review decision challenging OMB's authority to disapprove information-collection requirements (C) ..... July 27
U.S. Labor Dept. head will be Elizabeth Dole (C) ..... Jan 27
Laboratories—NIST launches consortium to develop a futuristic laboratory (N) ... Oct 64

**Lasers**
Laser-based chemical-vapor-deposition process makes ceramic fibers (C) . July 17
Wayne State's thermal wave technique measures thermal conductivity of diamond films (C) ..... Nov 21

**Law**
Acid-rain legislation ought to mandate a total 10-million-ton reduction in $SO_2$ emissions (C) ..... Mar 27
Air-pollution bill being prepared by Senate Committee (C) ..... Oct 27
Air toxics: Bill to reduce emissions of toxic air pollutants introduced (C) ..... May 27
Antitrust dispute over alleged predatory pricing in the waste-disposal market involving Browning-Ferris to be reviewed by Supreme Court (N) ..... Jan 48
City of Torrance, Calif. takes legal action to have Mobil Oil refinery declared a public nuisance (C) ..... May 23
Clean Air Act
Bush Administration's proposal to revise the Clean Air Act getting mixed reviews (C) ..... July 25
The debate starts anew on clean air. Dennis Melamed & Gerald Parkinson (N) ..... Aug *31
Clean Air battle heats up over alternative fuels for vehicles (C) ..... Nov 27
Clean Water Act
57 cities cited for toxic wastewater violations (C) ..... Nov 27
Congress:101st Congress opened its first session last month (C) ..... Feb 27
Energy see **Energy**
Environmental see **Air Pollution; Environment; Waste Disposal; Water Pollution; Water Supply**
FIFRA
Bush Administration is resisting efforts to tighten rules under FIFRA (C) ..... June 27
Genetics still not in the legal code: West German court revokes Hoechst permit to build a plant that would use genetically-altered organisms to make human insulin (C) ..... Dec 23
Hazardous-waste cleanups may become more expensive in wake of court ruling involving companies responsible for oil spills (C) ..... Aug 19
Natural gas prices: Congress is poised to remove remaining price regulations (C) ..... May 27
North Carolina law that allows the state to veto field testing of genetically engineered organisms getting mixed reviews from biotech industry (C) ..... Sept 27
OSHA's Hazard Communication Standard: Supreme Court to review decision challenging OMB's authority to disapprove information-collection requirements (C) ..... July 27
OMB allegedly stalls environmental, safety regulations (C) ..... Dec 25
Ozone controversy see **Ozone**
Plastics disposal: degradable vs. recyclable plastics' clash is brewing in Congress (C) ..... Mar 25
Plastics disposal: lawmakers from corn-belt states want to boost degradables containing corn-based fillers (C) .. Mar 25
RCRA
Action on RCRA is getting started (C) ..... Oct 27
Superfund see **Waste Disposal**
TSCA
EPA expected to propose biotechnology regulations under TSCA (C) ..... Jan 27
Underground storage tanks: Industry lags in complying with tank law (C) ... Dec 25
UC will pay $470 million to settle Bhopal-related litigation (C) ..... Mar 25
U.S. CPI read the President's lips: joint SOCMA/DCMA meeting. Susan Irving-Monshaw (N) ..... Mar 56

NOTES—*Illustrated; (C) Chementator; (Ed) Editor's Page; (N) Newsfront; (P.N.) Plant Notebook; (R) Reprints available

Washington prepares for 1990. Denise Kearns (N) (charts) ..... Dec 43

**Leaching**
Giant Bay Resources completes bioleach tests of gold (N) ..... June 66F
Preussag process cuts waste-sludge volume from ore leaching by about 80% (C) ..... Aug 11

Levulinic Acid—Proprietary route for making higher-purity levulinic acid, from Austria (C) ..... May 17

**Licensing**
NRC approves changes in the licensing process for new nuclear power plants (N) ..... June 66F
Zurn Industries is licensing Pedco's combustion technology (N) ..... June 66H

**Linings**
Flyash can make clay landfill-liners better barriers to organic contaminants (C) ..... Aug 17
Inspection: Key to quality masonry lining. Walter Lee Sheppard, Jr. ..... Mar *191
Lined landfill takes incinerator ash: polyethylene liner at Shrewsbury, Mass. "monofill" (P.N.) ..... Mar *186

Liquids—Equipment Focus: Broader options enhance solid-liquid separations ... June *151
Equipment and services ..... June *151
Manufacturers' literature ..... June 158

Lubrication—Solid metal-oxide lubricants able to withstand 500°C are being developed (C) ..... Feb 25


# M


**Magnetics**
Magnetic or electric fields might improve membrane selectivity (C) ..... Aug 17
Magnetic wastewater-treatment process meets phosphate-emission standards (C) ..... June 17
Producing magnetic particles in bacteria in Japan (C) ..... Oct 23

**Maintenance**
Confessions of a service engineer. George R. Kent
Part I: Troubleshooting vibration problems ..... Feb *145
Part II: Troubleshooting rotating equipment ..... Apr *163
Part III: Troubleshooting equipment vibration ..... July *171
Distillation columns: Troubleshooting distillation columns. Mark E. Harrison & John J. France (charts, graphs, diagrams)
Part 1: Technique and tools ..... Mar *116
Part 2: Packed columns ..... Apr *121
Part 3: Trayed columns ..... May *126
Part 4: Auxiliary equipment ..... June *130
Equipment Focus: Corrosion-resistant coatings slash maintenance costs . Dec *125
Equipment and services ..... Dec 126
Manufacturers' literature ..... Dec 133
Fired heaters: How to boost the performance of fired heaters. A. Garg (tables, chart, diagrams) ..... Nov 239
Flush away equipment problems. Richard P. Palluzi (table, graphs, diagrams) Jan *104
Heat exchangers: Getting top performance from heat exchangers. David F. Fijas (tables) ..... Dec *141
Heat exchangers, thermoplastic, offering lower maintenance costs (C) ..... Apr 19
Inspection: Key to quality masonry lining. Walter Lee Sheppard, Jr. ..... Mar *191
Nondestructive testing in the CPI—CE refresher. Frank J. Sattler (charts, diagrams)
Part 1: Improving quality through nondestructive testing ..... Apr *116
Part 2: Finding surface defects with nondestructive testing ..... July *125
Part 3: Finding below-surface defects with nondestructive testing .... Sept *161
Part 4: Nondestructive testing via optical and acoustical methods ..... Nov *191
Part 5: Improving plant maintenance via nondestructive testing ..... Dec *115
Malaysia—Shell's new Fischer-Tropsch gas-to-distillate process goes commercial (C) ..... Nov 23
Maleic Anhydride—Lively markets brighten maleic anhydride horizons. Susan Irving-Monshaw & Albert Kislin (N) (charts) Mar *35

**Management**
Chemical Process Safety Management Conference: Chemical process safety must be constantly managed...and sharing information is a good first step toward managing safety effectively (C) ..... Feb 23
Crisis management—Preparation: The key to crisis control. Roy M. Starks, Jr. ..... June *171
Go West, young *chelovyek*! USSR managers to study Western management (C) ..... Dec 23
Milliken Chemical's operator-self-managed process plant is a success (C) Jan 25
The New York Blower Co.: A hundred years later, ingenuity is still blowing strong (N) ..... Oct *62
People articles see **People**
The 'rights' of management. Jerry O. Dalton ..... Oct *173
The winning edge in negotiations. Robert W. Gallant ..... Nov *229

Masonry—Inspection: Key to quality masonry lining. Walter Lee Sheppard, Jr. . Mar *191

**Mass Transfer**
Better absorption? Try a static mixer. Robert G. Rader & others (diagrams, graphs) ..... July *137
A new correlation for sieve trays. Thomas J. Ward (P.N.) (graphs) ..... June 177

**Materials**
Australia's Neutralysis' novel way of making light aggregate uses wastes as fuel and a feedstock (C) ..... May 25
Building material can be made from waste gypsum in new German route (C). Aug 13
Crossflow microfilters: The ins and outs—report. Stephen L. Michaels (diagrams, tables) ..... Jan *84
—Letters ..... July 8
Diamonds catch the CPI's eye. Jayadev Chowdhury (N) ..... Sept *48
Equipment Focus: Composites lead the way in equipment construction ... Nov *215
Materials and equipment ..... Nov 217
Manufacturers' literature ..... Nov 222
Masonry: Inspection—Key to quality masonry lining. Walter Lee Sheppard, Jr. ..... Mar *191
The Minerals, Metals & Materials Society: Varied technical menu at metals meeting. Gerald Parkinson (N) ..... Apr 50
Pump wear rings: Keep the wear out of pump wear rings. Colin McCaul ... Oct *149
Sludge and ash are combined to make construction material (C) ..... Dec 23
Tin-based molecule may form new polymers (C) ..... Sept 23
Wayne State researchers find superconductors do better in an oxygen environment (C) ..... Nov 23

**Materials Handling**
Boon for solids handling: Agglomeration. Gerald Parkinson (N) ..... Aug *37
Equipment Focus: Clean outlook for solids handling ..... Nov *163
Manufacturers' literature ..... Nov 171
Equipment Focus: Electronics aid bulk materials handling ..... Sept *179
Manufacturers' literature ..... Sept 189
—Letter ..... Nov 8
Save money on drum-quantity waste disposal. Stephen A. Tzikas (table) .. Feb *118
Storage containers stack up savings (P.N.) ..... Aug *175

**Mathematics**
Boiling point gives critical temperature. Charles H. Fisher (tables) ..... Mar 157
Compressor performance: Key things to remember. Ronald P. Lapina (diagrams) ..... Aug *122
Designing sieve tray columns. Scott D. Barnicki & James F. Davis (diagrams, tables) ..... Oct 140
Part 1: Tray design ..... Oct 141
Part 2: Column design and verification ..... Nov 203
Draining tanks: How long does it really take? Mahnoosh Shoaei & Jude T. Sommerfield (P.N.) (diagram) ..... Jan 154
How to predict batch-reactor heating and cooling. John McEwan (P.N.) ..... May 179
How to predict *n*-alkane densities. Charles H. Fisher (P.N.) ..... Oct 195
Multiple regression: Harnessing the power of multiple regression. Dennis E. Johnson (chart, tables) ..... Nov 176
Multistage distillation: Fast analysis for multistage distillation. J.P. Tassoney (P.N.) ..... Oct 191
—Letters ..... Dec 7
A new correlation for sieve trays. Thomas J. Ward (P.N.) (graphs) ..... June 177
Numerical methods—CE Tutorial. Bernard Y. Tao (charts, tables, diagrams) (R)
7. Linear programming ..... July 146
Preventing corrosion in stacks and scrubbers. V. Ganapathy (P.N.) (diagrams) ..... Jan 152
A quick estimate for centrifugal-pump efficiency. Alejandro Anaya Durand (P.N.) (chart) ..... July 177
Reciprocating pumps: Bucking up reciprocating pump performance. John E. Miller (charts, diagrams) ..... Sept *149
Safer relief-valve sizing. Wing Y. Wong (charts, tables, diagram) ..... May *137
—Postscripts, corrections ..... Aug 7
A shortcut technique for finding $H_2SO_4$ concentration. C.M. Davidson (P.N.) (table) ..... Mar 185
Sizing the economic pipe. Byron D. Smith ..... Sept *201

**Measurements**
'Hot' technique measures $SO_2$ in stack gas (C) ..... Oct 21
Massflow measurement of solids in pneumatic conveying units is possible with GranuCor (C) ..... June 19
Moisture content: Two ways to check moisture content. Nigel P. Brown (P.N.) ..... Aug *173
Vacuum gages: Select the right vacuum gage. D.L. Roper & J.L. Ryans (charts, tables, nomograph, diagrams) .... Mar *125
Meetings—CE Alert—Meetings 1989 (tables) ..... Jan 113
..... Feb 48
Meetings See also specific meeting

**Membranes**
Abrasion-resistant ceramic membranes being evaluated as media to separate pollutants from high-temperature gases (C) ..... Jan 25
Allied-Signal's electrodialytic bipolar-membrane technology wins Kirkpatrick Honor Award (C) ..... Oct 19
Allied-Signal Aquatech acid recovery system—Kirkpatrick Honorable Mention (diagram) ..... Dec *81
Bend Research membrane system for removing organic contaminants from waste streams (N) ..... Feb 48E
Diesel fuel: a new source of drinking water, U.S.Army contract with Bend Research (C) ..... Dec 21
Dow's new membrane system, Generon HP, produces 99.9%-pure nitrogen (C) ..... June 17
Magnetic or electric fields might improve membrane selectivity (C) ..... Aug 17
Membranes can save energy in gas clean-up...and in extracting water vapor from air streams (C) ..... Dec 21
Membranes: The new actors in liquid separations (N) ..... Dec *37
Microporous membranes improve composites molding (P.N.) (diagram) ..... Sept *211
MTR's membranes remove 90-99% of chlorofluorocarbons from air streams (C) ..... May 25


NOTES—*Illustrated; (C) Chementator; (Ed) Editor's Page; (N) Newsfront; (P.N.) Plant Notebook; (R) Reprints available

Novel separator, combining ultrafiltration membranes with centrifugal action makes its debut at California food processor. Gerald Parkinson (N) ..... Jan 44

**Metallurgy**

Hydrometallurgical copper-recovery process could replace smelting (C) ... Mar 21

Rhenium production being stepped up via process modifications by Cyprus Minerals (C) ..... June 25

**Metals**

Equipment Focus: Composites lead the way in equipment construction ... Nov *215
Materials and equipment ..... Nov 217
Manufacturers' literature ..... Nov 222

Minerals, as well as petroleum, may be recovered from Canadian tar sands through Solv-Ex process (C) ..... Apr 17

The Minerals, Metals & Materials Society: Varied technical menu at metals meeting. Gerald Parkinson (N) ..... Apr 50

Removal of heavy metals from wastewater—with guaranteed performance—offered by Tetra (C) ..... June 23

Sweden: A sound method for degreasing metal parts (C) ..... Oct 23

Meters see **Flowmeters; Spectrometry**

**Methanol**

Floating methanol plant will be moored off Oman (N) ..... May 49

Methanol: too expensive for auto fuel? (C) ..... Dec 21

Methanol-powered bus goes into service in LA (N) ..... June 66H

Synthesis of methanol via methyl formate appears commercially promising (C) ..... May 21

Two-stage de-$NO_x$ route injects urea and methanol (C) ..... July 19

Methyl Formate—Synthesis of methanol via methyl formate appears commercially promising (C) ..... May 21

Methyl Methacrylate—Mitsubishi will try out new route for MMA (C) ..... July 23

Micromachining—Shrinking CPI equipment—no small feat. Jayadev Chowdhury (N) ..... May *31

Microwaves—Australian microwave 'factory' speeds synthesis of chemical compounds (C) ..... Nov 17

The Minerals, Metals & Materials Society—Varied technical menu at metals meeting. Gerald Parkinson (N) ..... Apr 50

Mining—Mining concerns fighting EPA's attempts to regulate mineral processing wastes (C) ..... June 27

**Mixers**

Better absorption? Try a static mixer. Robert G. Rader & others (diagrams, graphs) ..... July *137

Equipment Focus: Mixers: A variety of equipment for varied services .... July *115
Manufacturers' literature ..... July 119

Equipment Focus: New twists in mixers and blenders ..... Jan *127
Equipment and services ..... Jan 128
Manufacturers' literature ..... Jan 134
—Postscripts, corrections ..... Mar 7

Modernization—Anatomy of a revamp: Unichema's Chicago oleochemicals plant (P.N.) ..... Apr *174

**Molding**

Microporous membranes improve composites molding (P.N.) (diagram) ..... Sept *211

Plastics: From pellets to products. Dale E. Witwer (diagrams) ..... Sept *123

Molecular Sieves—Great Britain: molecular-sieve system for capturing fugitive emissions will be pilot tested (C) ..... Feb 19

Molecules—Tin-based molecule may form new polymers (C) ..... Sept 23


## N


2,6-Naphthalene Dicarboxylic Acid—Mitsubishi building semicommercial plant (C) ..... July 23

**Natural Gas**

BASF complex will get its own gas pipeline (C) ..... Dec 19

Gasification see **Gasification**

Prices: Congress is poised to remove remaining price regulations (C) ..... May 27

Shell's new Fischer-Tropsch gas-to-distillate process goes commercial in Malaysian plant (C) ..... Nov 23

**Netherlands**

DCH route, new way to detoxify liquid organic wastes, proposed for central hazardous-waste-treatment facility (C) ..... Aug 11

DSM eyes new polymer markets (N) Jan 48H

Magnetic wastewater-treatment process meets phosphate-emission standards (C) ..... June 17

Shell's coal-gasification process will get its first commercial-scale tryout (C) .. July 17

Shell Nederland hydrogenation process uses a continuous circulating catalyst (N) ..... Aug 56G

Nickel—A reliable base for high-nickel equipment. James L. Gossett (tables) ..... May *145

**1989 Chemical Process Industries Exposition**

Chem Show '89 ..... Nov *93
New products and services highlights ..... Nov *95
Show highlights ..... Nov 116

Nitration—ICI's new nitrating agent limits side reactions (C) ..... Nov 23

**Nitrogen**

Air Products' process improvements promise cheaper nitrogen (C) ..... Dec 19

Dow's new membrane system, Generon HP, produces 99.9%-pure nitrogen (C) ..... June 17

How to purge small vessels with nitrogen. William A. Levinson (P.N.) (chart) Nov 249

UC's VPSA: Gas-separation technology boasts lower costs (C) ..... Oct 17

**Nitrogen Oxide**

FERC's process: One shot socks $SO_x$ and $NO_x$ (C) ..... Nov 25

Noxso process that removes both $NO_x$ and $SO_x$ begins pilot-scale tests (C) .. June 21

Quick conversion of $NO_x$ and CO emission rates. V. Ganapathy (P.N.) (chart) Dec 149

Solar Turbines program aimed at reducing $NO_x$ emissions from a diesel-fueled industrial turbine (N) ..... Aug 55

Two-stage de-$NO_x$ route that injects urea and methanol removes 65-80% of nitrogen oxides from fluegas (C) ..... July 19

Norway—Norsk Hydro will pilot test new heat exchanger that is small, but keeps its cool (C) ..... Dec 17

Nöthen, Karl of Bayer AG—A West German engineer's "open door" policy. Eric Johnson ..... Apr *59


## O


**Occupational Safety & Health Administration**

Exposure limits for 428 toxic substances become effective Mar. 1 (C) ..... Feb 27

Hazard Communication Standard: Supreme Court to review decision challenging OMB's authority to disapprove information-collection requirements (C) ..... July 27

Occupational Safety & Health Administration See also **Labor**—OSHA; **Safety**—OSHA

Odor Control—Corrosion-resistant resin aids in odor abatement (P.N.) ..... Dec *155

Oils & Fats—Fat replacers: Eat and stay thin (C) ..... Nov 25

Olefins—Olefins-separation process offers lower costs and higher capacities for ethylene plants (C) ..... Aug 15

Optics—Polysilynes, a class of plastics with novel optical properties, created by AT&T researchers (C) ..... Aug 13

Organic Chemicals—Making organic chemicals via electrochemical processing. Joseph E. Toomey, Jr. & Jimmy C. Yu (charts, tables, diagrams) ..... June *140
—Postscripts, corrections ..... July 10

**Oxidation**

Oxidizing wastes electrochemically: U.K.'s AEA process (C) ..... Sept 17

Ultrox process combining radiation and oxidation may reduce toxic-organics levels in wastewater (C) ..... Apr 19

**Oxygen**

Predict safe oxygen in combustible gases. T.K. Subramaniam & Joseph V. Cangelosi ..... Dec 108
Correction ..... Jan 1990 8

UC's novel oxygen enhanced combustion of hazardous wastes wins 1989 Kirkpatrick Chemical Engineering Achievement Award (C) Oct-19, (diagram) ..... Dec *79

UC's oxygen-combustion technology wins a process patent (C) ..... Dec 17

UC's VPSA: Gas-separation technology boasts lower costs (C) ..... Oct 17

Wayne State researchers find superconductors do better in an oxygen environment (C) ..... Nov 23

**Ozone**

Ozone controversy
Alternatives to CFC see **Chlorofluorocarbons**
The greenhouse effect...and the Green Man—Letters ..... May 7
$CCl_4$ and $CH_3CCl_3$ may be added to the Montreal Protocol (C) ..... May 27
CFCs: Tax, don't ban, CFCs—Letter ..... Aug 7
Tax proposal could make chlorofluorocarbons more expensive to use (C) Aug 19
Irvine, CA passes toughest law on ozone-depleting compounds (N) . Aug 52
Greenhouse gases: international movement to regulate emissions (N) . Aug 56
Air-pollution bill being prepared by Senate Committee (C) ..... Oct 27


## P


Packaging—Paperboard packaging market (N) ..... Aug 56D

Packings—Equipment Focus: Seals and packings ..... June *99
Equipment and services ..... June *99
Bigger and better seals and bearings handle diverse applications ..... June *101

**Paint**

Paint giving off none or few of the volatile-organic-compound emissions being developed (C) ..... July 23

UC system in which supercritical $CO_2$ replaces hydrocarbon solvents could reduce emissions of volatile organic compounds from paints by 30-70% (C) . Aug 11

Paper see **Pulp & Paper**

**Particles**

Electrostatic device agglomerates small particulates (C) ..... Sept 19

Particle-modification technology, The Hybridizer, now available in the U.S. (C) Apr 19

**Patents**

Bayer-Sulzer-Escher Wyss patent battle over sulfuric acid-recycle process (N) Jan 39, (C) ..... Apr 23
—Letter ..... May 7

UC's oxygen-combustion technology wins a process patent (C) ..... Dec 17

**People**

Bonner, Timothy A. of Monsanto: Understanding customers. Sandy Edwards ..... June *69

Coykendall, John of FMC: The soda ash king. Sandy Edwards ..... July *65

Gaumer, Lee of Air Products and Chemicals: Nurturing our best. Sandy Edwards ..... Nov *71

Hunt, Charles of Ethyl: Managing the 'model' plant. Sandy Edwards .... Sept *79
—Letter ..... Dec 7


NOTES—*Illustrated; (C) Chementator; (Ed) Editor's Page; (N) Newsfront; (P.N.) Plant Notebook; (R) Reprints available

Kavasmaneck, Percy of Union Carbide: Don't burn the toast. Sandy Edwards ..... Mar *69
Nöthen, Karl of Bayer AG: A West German engineer's "open door" policy. Eric Johnson ..... Apr *59
Robb, Dr. Walter of GE: The goal is flexibility. Sandy Edwards ..... Oct *71
Shelton, James of Dow Chemical: Getting it right the first time. Sandy Edwards ..... Jan *49
Smith, Bryan of ICI: The priority of engineering. Eric Johnson ..... Aug *59
Stewart, Richard of Du Pont: The kind of guy you trust. Sandy Edwards ... Feb *55
Trobaugh, Benson of Merck: How do you stay competitive? Sandy Edwards May *57
Yandle, Gerald of Hercules: Adapt to change. Sandra Edwards ..... Dec *51

**Pesticides**
EPA regulation
EPA cancels pesticides permits and proposes a new policy (C) ..... Dec 25
FIFRA: Bush Administration is resisting efforts to tighten rules under FIFRA (C) ..... June 27
Petro Expo '89—Preview: New products ..... Mar *85

**Petrochemicals**
Catalysts: Designer catalysts are all the rage. Gerald Parkinson & Eric Johnson (N) ..... Sept *30
—Letter ..... Dec 7
Petro Expo '89 Preview Mar *85

**Petroleum**
Catalysts: Designer catalysts are all the rage. Gerald Parkinson & Eric Johnson (N) ..... Sept *30
—Letter ..... Dec 7
Crude oil: free-world demand (N) .... Oct 68E
Imports: U.S. oil imports are expected to increase (C) ..... Sept 27
Minerals, as well as petroleum, may be recovered from Canadian tar sands through Solv-Ex process (C) ..... Apr 17
Oil spills
Experimental technology for oil spill containment and recovery (OSCAR) being tested in Valdez, Alaska (C) May 17
Hazardous-waste cleanups may become more expensive: court ruling says companies responsible for oil spills should pay the cost of restoring the environment to its previous condition (C) ..... Aug 19
Native microorganisms being tested for cleaning up the oil spill in Prince William Sound, Alaska (C) ..... July 25
Production: U.S. crude-oil and petroleum-condensate production fell 2.3% in 1988 (C) ..... Feb 25
Refineries & refining
City of Torrance, Calif. takes legal action to have Mobil Oil refinery declared a public nuisance (C) .... May 23
Liquefied-gas solvent-extraction process for waste treatment of refinery sludges (C) ..... July 19
Slow growth predicted for U.S. petroleum industry: Chem Systems report (C) Dec 17
Sumitomo catalyst removes more sulfur from petroleum (C) ..... Nov 17
Taxes: House approves taxes on CFCs, crude oil (C) ..... Nov 27
Phenolics—Biomass-to-phenolics route moves closer to market (C) ..... Sept 25

**Phosphate**
Magnetic wastewater-treatment process meets phosphate-emission standards (C) ..... June 17
Phosphate waste could be converted to phosphoric acid with USBM process (C) ..... Mar 21
Phosphoric Acid—Phosphate waste could be converted to phosphoric acid with USBM process (C) ..... Mar 21

**Photography**
Photography in engineering. Harold W. Russell
Part 1: Applications ..... Jan *137
—Letters ..... Apr 7
Part 2: Equipment (Be a photographic engineer) ..... Feb *137

**Physical Properties**
Finding the properties of hydrofluoric acid. José Vincente Gómez (P.N.) (table) ..... Feb 152
—Postscripts, corrections ..... June 8
How to predict *n*-alkane densities. Charles H. Fisher (P.N.) ..... Oct 195

**Pilot Plants**
Automatic process control for pilot plants: Dow-developed product, the Camile data-acquisition and control unit (P.N.) ..... June *181
Exxon starts up high-pressure polyethylene pilot plant in Belgium (C) .... July 25

**Pipe & Pipelines**
BASF complex will get its own gas pipeline (C) ..... Dec 19
Basalt-lined pipe stands up to boric acid (P.N.) ..... July *182
Equipment Focus: New piping systems enter the mainstream ..... May *111
Equipment and services ..... May *112
Manufacturers' literature ..... May 122
How to organize pipe tie-ins for revamp projects. Stephen E. Wyss (diagrams) ..... Feb 107
Japanese firms charged with dumping pipe products in the U.S. (N) .... June 66H
Sizing the economic pipe. Byron D. Smith ..... Sept *201
Plant Construction—Modular construction: Deciding when to use modular construction—ACT (Advanced Construction Technology). Robert Clement (P.N.) ..... Aug *169

**Plant Design**
Anatomy of a revamp: Unichema's Chicago oleochemicals plant (P.N.) ..... Apr *174
Herzog-Hart's M.O.S.T. concept: A way to design and build batch fine-chemical plants cost-effectively (C) ..... Apr 17
$NH_3$ break thru: Small plants; ICI's Leading Concept Ammonia Process. Herb Short (N) (flowchart) ..... July *41
Plant Location—Floating methanol plant will be moored off Oman (N) ..... May 49

**Plant Notebook**
Analyzer takes a fast reading ..... July *184
Anatomy of a revamp: Unichema's Chicago oleochemicals plant ..... Apr *174
Automated waste recovery cuts materials and disposal costs ..... Jan *150
Automatic process control for pilot plants ..... June *181
Basalt-lined pipe stands up to boric acid ..... July *182
Batch controller helps boost output . Mar *187
Calculate insulation thickness for personnel protection. Win Irwin (table) .. Sept *207
Compute relative humidity *quickly*. P.H. Pallady ..... Nov 255
Controller raises air and process capacity. Jon Pratt ..... Feb *151
Corrosion-resistant resin aids in odor abatement ..... Dec *155
Deciding when to use modular construction. Robert Clement ..... Aug *169
Draining tanks: How long does it really take? Mahnoosh Shoaei & Jude T. Sommerfield (diagram) ..... Jan 154
Dry seal keeps pharmaceuticals clean June *182
Evaporator keeps plating solutions on target ..... July *178
Fast analysis for multistage distillation. J.P. Tassoney ..... Oct 191
—Letters ..... Dec 7
Finding the properties of hydrofluoric acid. José Vincente Gómez (table). Feb 152
—Postscripts, corrections ..... June 8
Heat-transfer fluid solves coking problems ..... Sept *215
How to keep track of instruments. Walter Driedger ..... Apr *171
How to predict batch-reactor heating and cooling. John McEwan ..... May 179
How to predict *n*-alkane densities. Charles H. Fisher ..... Oct 195
How to purge small vessels with nitrogen. William A. Levinson (chart) ..... Nov 249
A larger centrifuge separates more materials in less time for Dow ..... Jan *149
Lined landfill takes incinerator ash . Mar *186
Microporous membranes improve composites molding (diagram) ..... Sept *211
Mist eliminators help raise sulfur-removal capacity at Kidd Creek ..... Nov *263
Mobile lab provides on-the-spot testing ..... Mar *188
A new correlation for sieve trays. Thomas J. Ward (graphs) ..... June 177
A pressure filter for high dewatering May *182
Preventing corrosion in stacks and scrubbers. V. Ganapathy (diagrams) .... Jan 152
Quick conversion of $NO_x$ and CO emission rates. V. Ganapathy (P.N.) (chart) Dec 149
A quick estimate for centrifugal-pump efficiency. Alejandro Anaya Durand (chart) ..... July 177
Scrubber eliminates ethylene oxide . Dec *153
A shortcut technique for finding $H_2SO_4$ concentration. C.M. Davidson (table) ..... Mar 185
Solvent unit cleans synthesis gas. R.J. Hernandez & T.L. Huurdeman (flowchart, tables) ..... Feb 154
Spiral heat exchanger resists clogging ..... June *184
Steam cleaning for dirty soil ..... May *180
Storage containers stack up savings Aug *175
Triple-effect evaporator aids in byproduct recovery at Jack Daniel Distillery (flowchart) ..... Nov *259
Two ways to check moisture content. Nigel P. Brown ..... Aug *173
Wastewater treatment unit, ISEP, closes the ammonium loop ..... Oct *197
X-ray fluoroscope helps copper platers Apr *176

**Plant Operation**
Confessions of a service engineer. George R. Kent
Part I: Troubleshooting vibration problems ..... Feb *145
Part II: Troubleshooting rotating equipment ..... Apr *163
Part III: Troubleshooting equipment vibration ..... July *171
Crisis management—Preparation: The key to crisis control. Roy M. Starks, Jr. ..... June *171
Distributed control: A primer—report May *87
Understanding distributed control. Dale R. Snyder ..... May *87
Controlling continuous processes with DCS. John R. Funk & Larry McAllister (charts) ..... May *90
DCS for batch process control. Donald J. Modell (diagrams, tables) ..... May *97
Engineering workstations improve productivity. Benjamin T. Condon (diagrams) ..... May *104
Heat exchangers: Getting top performance from heat exchangers. David F. Fijas (tables) ..... Dec *141
How to organize pipe tie-ins for revamp projects. Stephen E. Wyss (diagrams) ..... Feb 107
Milliken Chemical's operator-self-managed process plant is a success (C) . Jan 25
Planning cuts the cost of retrofitting controls. Donald L. May & Donald W. Koontz (diagrams, chart) ..... Oct *181
Pumps: Changes in pump design can reduce seal failures. Richard Antkowiak ..... May *173
Sizing the economic pipe. Byron D. Smith ..... Sept *201
Troubleshooting distillation columns. Mark E. Harrison & John J. France (charts, graphs, diagrams)
Part 1: Technique and tools ..... Mar *116
Part 2: Packed columns ..... Apr *121
Part 3: Trayed columns ..... May *126
Part 4: Auxiliary equipment ..... June *130
Plant Startups—How to organize pipe tie-ins for revamp projects. Stephen E. Wyss (diagrams) ..... Feb 107
Plasma—TAFA introducing induction plasma system (N) ..... Oct 68G


NOTES—*Illustrated; (C) Chementator; (Ed) Editor's Page; (N) Newsfront; (P.N.) Plant Notebook; (R) Reprints available

Plastic Film—Du Pont plans to double polyimide film capacity (N) ... Oct 68I

**Plastics**

Autos set a fast pace for thermoplastics. Benno Groeneveld (N) (table) ... Feb 35
Banning plastics is not the way to solve solid-waste problems (C) ... June 25
Biodegradable plastics from polysaccharides in Japan (C) ... Sept 19
Biodegradable plastics from potato waste (C) ... Sept 19
Degradable vs. recyclable plastics' clash is brewing in Congress (C) ... Mar 25
Degradables containing corn-based fillers pushed by lawmakers from corn-belt states (C) ... Mar 25
Equipment Focus: Composites lead the way in equipment construction ... Nov *215
Materials and equipment ... Nov 217
Manufacturers' literature ... Nov 222
Plastics: From pellets to products. Dale E. Witwer (diagrams) ... Sept *123
Polysilynes, a class of plastics with novel optical properties, created by AT&T researchers (C) ... Aug 13
Recycled plastics could improve concrete (C) ... Sept 25
Recycling: Du Pont and Waste Management set up 50-50 joint venture (C) ... May 19
Recycling: Plastics recycling picks up momentum. Nicholas Basta & Eric Johnson (N) (chart) ... July *30
UCLA developing heat treatment technique that could result in stronger plastics (C) ... June 21
West German plastics producers report record year in 1988 (N) ... June 62
Plastics See also specific plastic
Plating—X-ray fluoroscope helps copper platers (P.N.) ... Apr *176
Politics—Bush nominates William Reilly to head EPA; other Bush choices include Elizabeth Dole to head Labor Dept. and Manuel Lujan Jr. for Secretary of the Interior Dept. (C) ... Jan 25
Polyacrylamide—Flocculant for alumina production that offers better process-liquor clarity from American Cyanamid (C) ... Mar 23

**Polychlorinated Biphenyls**

GE successfully employs biodegradation for destroying PCBs in contaminated river sediments (N) ... Dec 4[illegible]D
German process that could clean up chlorinated wastes at 1/3 to 1/2 the cost of incineration will debut in mobile unit (C) ... Feb 17
KPEG process for cleaning up PCB-tainted soil achieves 99.8% removal of PCBs in field tests (C) ... July 21
New bacteria destroy PCBs in a single step (C) ... Sept 21
Onsite or offsite reprocessing of PCBs: which is better? (N) ... Aug 56D

**Polyethylene**

DSM eyes new polymer markets: plans Dyneema, PE fiber, plant (N) ... Jan 48H
Exxon starts up high-pressure polyethylene pilot unit in Belgium (C) ... July 25
LLDPE: construction of first commercial LLDPE plant using BASF technology to begin in West Germany (C) ... Apr 21
Phillips' explosion and fire wipes out 15-20% of U.S. HDPE capacity (C) ... Nov 17
Polyimides—Du Pont plans to double polyimide film capacity (N) ... Oct 68I

**Polymers**

Baghouses: A hot and dirty future for baghouses. Gerald Parkinson (N) Apr *30
—Postscripts, corrections ... June 8
—Letter ... Sept 8
DSM eyes new polymer markets (N) Jan 48H
Du Pont announces expansion plans (C) ... Jan 17
Exxon catalysts make better polymers (C) ... Nov 23
Polymer sinter, Porosoft, from Japan has novel absorption properties (C) ... Oct 25
3M space processing tests on polymeric materials may have down-to-Earth benefits (C) ... Nov 27
Tin-based molecule may form new polymers (C) ... Sept 23
UCLA developing heat treatment technique that could result in stronger plastics (C) ... June 21
Polypropylene—Himont offers new process for making PP with better properties (C) ... May 17
Polysaccharides—Degradable plastics from polysaccharides in Japan (C) ... Sept 19
Polysilynes—A class of plastics with novel optical properties created by AT&T researchers (C) ... Aug 13
Polystyrene—Recycling: first recycling of used polystyrene in the U.S. will begin next month (C) ... Jan 21

**Portugal**

Portugal moves to privatize its CPI. Eric Johnson (N) ... July 52
Route exploits low-grade complex sulfides: Varied technical menu at metals meeting. Gerald Parkinson (N) ... Apr 50
Powder & Bulk Solids Conference & Exhibition—Preview: New product highlights ... Apr *71
Preservation—Process that can preserve books printed on acidic paper (C) ... Aug 13
Pressure Vessels—ASME Boiler and Pressure Vessel Code is going electronic (C) ... May 19
Prices—Energy prices will rise in the 1990s. Dennis Melamed & others (N) (chart, table) ... Sept 55
Problem Solving—How to stimulate the innovation process. Walter J. Eldredge July *187
Process Equipment—A reliable base for high-nickel equipment. James L. Gossett (tables) ... May *145

**Product Development**

Catalysts: Designer catalysts are all the rage. Gerald Parkinson & Eric Johnson (N) ... Sept *30
—Letter ... Dec 7
U.S. consumers are turning 'green': survey finds The Nineties will be the decade of products with a strong environmental perspective (C) ... Oct 19
Production—Operating rates: Capacity utilization in the U.S. chemical industry is at 89.9% (C) ... Feb 17
Productivity—Distributed control report: Engineering workstations improve productivity. Benjamin T. Condon (diagrams) ... May *104

**Professional Development**

Desktop publishing: For dressing up engineers' reports. Len Egol ... May *185
How to speak so facts come alive. Morey Stettner ... Sept *195
Profitability—Estimate profitability using net return rate. Thomas J. Ward (charts, diagrams) ... Mar *151
Project Engineering—Estimate profitability using net return rate. Thomas J. Ward (charts, diagrams) ... Mar *151
Propellanes—Tin-based molecule may form new polymers (C) ... Sept 23

**Protein**

Chiron licenses Phillips' yeast gene to make proteins (N) ... Oct 64
In vitro injection of DNA coded to produce pharmaceutical proteins in the eggs of cows (C) ... Aug 9
Protein crystals grown on the Space Shuttle may lead to new drugs (C) ... Apr 21

**Public Relations**

Crisis management—Preparation: The key to crisis control. Roy M. Starks, Jr. ... June *171
Technology: a mixed perception—INIFES survey analysis (C) ... Sept 23
Videotapes: It's *fast forward* for CPI videomakers. Susan Irving-Monshaw (N) ... Oct *37

**Pulp & Paper**

Canada: major investments in the pulp and paper industry announced for Alberta (C) ... Jan 19
China: Red carpet welcome for U.S. waste paper. Reginald Rhein (N) ... Mar 64E
No paper tiger (Ed) ... Mar 5
Paper mill study: Dioxin found in fish and wastewater downstream from paper mills (C) ... Apr 27
Paperboard packaging market (N) ... Aug 56D
Papermakers go electronic. Nicholas Basta (N) (charts) ... Mar 30
—Postscripts, corrections ... June 8
Process that can preserve books printed on acidic paper (C) ... Aug 13
Pulse combustion gets a big tryout at pulp mill. Gerald Parkinson (N) ... July 51

**Pumps**

Centrifugal pump automatically handles low flows and shutoff (C) ... Aug 9
Centrifugal pumps: A quick estimate for centrifugal-pump efficiency. Alejandro Anaya Durand (P.N.) (chart) ... July 177
Centrifugal pumps—report (charts, tables, diagrams) ... July *96
Better standards, better pumps. Paul T. Lahr ... July *96
Coming soon: New ANSI pump standard. John A. Reynolds ... July *98
Now here: Revised API pump standard. John W. Dufour ... July *101
Better seals will boost performance. Raymond E. Battilana ... July *106
—Postscripts, corrections ... Sept 8
Equipment Focus: New pumps offer greater versatility ... Feb *83
Equipment and services ... Feb *83
Equipment Focus: Pumps leak less, last longer in severe service ... Oct *159
Manufacturers' literature ... Oct 167
High-nickel-alloy pumps: A reliable base for high-nickel equipment. James L. Gossett (tables) ... May *145
Leakproof pumps: Surging interest in leakproof pumps. Gerald Parkinson & Eric Johnson (N) (diagram) ... June *30
Choices widen for magnetically driven pumps ... June 35
—Letter ... Aug 7
—Postscripts, corrections ... Oct 8
Plagued by pumping problems? Consider the flexible-impeller pump. Don L. Watkins Jr. (tables, graph) ... Jan *94
Reciprocating pumps: Bucking up reciprocating pump performance. John E. Miller (charts, diagrams) ... Sept *149
Seal failures: Changes in pump design can reduce seal failures. Richard Antkowiak ... May *173
U.S. shipments of centrifugal and turbine pumps (N) ... Nov 64
Vacuum pump from Japan features ceramic rotor assembly (C) ... Oct 17
Warman International's Type Z submersible pump—Postscripts, corrections ... June 8
Wear rings: Keep the wear out of pump wear rings. Colin McCaul ... Oct *149

**Purchasing**

How good are CPI products? (survey including questionnaire) ... Apr *92
Readers rate CPI products (survey results). Nicholas Basta & Jayadev Chowdhury (charts, tables) ... Oct *104
Quality should be everybody's business (Ed) ... Oct 5
Purging—How to purge small vessels with nitrogen. William A. Levinson (P.N.) (chart) ... Nov 249
Purification—Salt-purification system with one-fourth the energy costs (C) ... Aug 9
Pyrolysis—Biomass-to-phenolics route moves closer to market (C) ... Sept 25


## Q


**Quality Control**

Dry seal keeps pharmaceuticals clean (P.N.) ... June *182


NOTES—*Illustrated; (C) Chementator; (Ed) Editor's Page; (N) Newsfront; (P.N.) Plant Notebook; (R) Reprints available

How good are CPI products? (survey including questionnaire) ..... Apr *92
Readers rate CPI products (survey results). Nicholas Basta & Jayadev Chowdhury (charts, tables) ..... Oct *104
Nondestructive testing in the CPI —CE Refresher. Frank J. Sattler (charts, diagrams)
Part 1: Improving quality through nondestructive testing ..... Apr *116
Part 2: Finding surface defects with nondestructive testing ..... July *125
Part 3: Finding below-surface defects with nondestructive testing .... Sept *161
Part 4: Nondestructive testing via optical and acoustical methods ..... Nov *191
Part 5: Improving plant maintenance via nondestructive testing ..... Dec *115
Quality should be everybody's business (Ed) ..... Oct 5


# R


**Radiation**
Combustion Engineering developing way to eliminate $SO_2$ via radiation with high-energy electrons (C) ..... Feb 25
Ultrox process combining radiation and oxidation may reduce toxic-organics levels in wastewater (C) ..... Apr 19
Radio Frequency—Waste-site decontamination by a new in situ radiofrequency process from Weston (C) ..... June 17
Railroads—What do you do with old railroad ties? Recycle them (C) ..... Oct 21
Reactions—Data on chemical reaction rates contained in computerized database from NIST (C) ..... June 23
**Reactors**
Australian microwave 'factory' speeds synthesis of chemical compounds (C) ..... Nov 17
BioTechnetics' immobilized-cell bioreactor wins Kirkpatrick Honor Award (C) Oct 19
BioTechnetics mammalian-cell bioreactor—Kirkpatrick Honorable Mention (diagram) ..... Dec *82
Fischer-Tropsch reactor, costing 30-40% less than conventional units, being started up at Sasol complex (C) ..... Apr 19
How to predict batch-reactor heating and cooling. John McEwan (P.N.) ..... May 179
How to purge small vessels with nitrogen. William A. Levinson (P.N.) (chart) Nov 249
Nuclear power reactor: Information, please—Letter ..... Feb 7
Three Mile Island Unit 2 cleanup almost finished (N) ..... June 66E
Recordkeeping—How to keep track of instruments. Walter Driedger (P.N.) .. Apr *171
Refineries & Refining see **Petroleum.**
**Reformers**
Heat-pipe reformer design may result in units that are 30% more efficient (C)Apr 17
Silberring looking for a hydrogen user to demonstrate a novel steam reformer (C) ..... Feb 17
Refractory Materials—Inhalation of refractory ceramic fibers may pose a health hazard (C) ..... Apr 25
Refrigeration—Lightweight insulation for refrigeration (N) ..... Aug 56
**Reliability**
How good are CPI products? (survey including questionnaire) ..... Apr *92
Readers rate CPI products (survey results). Nicholas Basta & Jayadev Chowdhury (charts, tables) ..... Oct *104
Quality should be everybody's business (Ed) ..... Oct 5
**Research**
AIChE forms a Center for Waste Reduction Technologies (C) ..... Dec 25
Bush maps out a plan for global climate research (C) ..... Oct 27
Catalysts: Conjuring up catalysts (Ed) ..... Sept 5
Catalysts: Designer catalysts are all the rage. Gerald Parkinson & Eric Johnson (N) ..... Sept *30
—Letter ..... Dec 7
Databases: A wealth of information online—report. Nicholas P.Chopey & others ..... June *112
—Postscripts, corrections July-10, Aug 7
—Letters Sept-8, ..... Dec 7
Engineering Research Centers: The jury is still out. Reginald Rhein (N) (chart)May *41
Engineers give guess-timates of technology advances 111 years from now (C) ..... Mar 23
EPO signs three companies to develop an online service called Epoque (N) . June 58
European research programs (3) closely related to CPI activities approved for funding (N) ..... June 66E
Millipore has opened a joint biotechnology R&D center in the U.S.S.R (C) ... Feb 23
NIST computerized database contains data on chemical reaction rates (C)June 23
NIST database adds more than 6,000 new mass spectra (N) ..... Feb 48F
NSF funds five science and technology centers that focus on chemical engineering research (C) ..... Jan 23
The online database explosion (Ed) . June 5
R&D budget: No big surprises in Bush's R&D budget. Reginald Rhein (N) . Mar 50
R&D spending: corporate restructuring hurt R&D spending in 1986 and 1987 (C) ..... Mar 27
R&D spending: U.S. corporate R&D spending continues to limp (C).... Aug 9
Superconductivity research triple collaboration: Du Pont, Hewlett-Packard and Los Alamos National Laboratory (C) ..... July 23
Technology: a mixed perception—INIFES survey analysis (C) ..... Sept 23
USDA developing edible, transparent coatings: goal of research program is sliced fruits and vegetables that stay fresh for at least a week (C) ..... May 21
**Resin**
Corrosion-resistant resin aids in odor abatement (P.N.) ..... Dec *155
Dow process boosts resin quality (C) Dec 19
Dow resin adsorption system for removing bitterness from orange juice being used by CCPI (C) ..... June 21
Du Pont will build world's largest ethylene-vinyl-alcohol resins plant; other plants announced (C) ..... Jan 17
Plastics: From pellets to products. Dale E. Witwer (diagrams) ..... Sept *123
Uniform-sized ion-exchange resins from Dow are stronger and last longer (C) ..... Nov 17
Resin See also specific resin
**Retrofitting**
Anatomy of a revamp: Unichema's Chicago oleochemicals plant (P.N.)..... Apr *174
FERC process designed for retrofit: One shot socks $SO_x$ and $NO_x$ (C)..... Nov 25
Planning cuts the cost of retrofitting controls. Donald L. May & Donald W. Koontz (diagrams, chart) ..... Oct *181
**Reverse Osmosis**
Evaporate and crystallize waste brines. Dennis Anthony (tables, flowchart) Apr *138
—Letters ..... July 8
Juice-concentration system combining ultrafiltration and reverse osmosis (C)Aug 17
Saudi Arabia's RO plant: a way to reduce the cost of water desalination will get its first application (C)..... Feb 21
Rhenium—Production being stepped up via process modifications by Cyprus Minerals (C) ..... June 25
Rings—Keep the wear out of pump wear rings. Colin McCaul ..... Oct *149
Robb, Dr. Walter of GE—The goal is flexibility. Sandy Edwards ..... Oct *71
**Russia**
Coal-water-slurry project: startup of a "fully integrated" CWS project has begun (C) ..... Jan 23
Generating electric power with small size windmills (N)..... Dec 48D
Go West, young *chelovyek*! USSR managers to study Western management (C) ..... Dec 23
Method of speeding up construction of storage tanks (N)..... Dec 48D
Millipore has opened a joint biotechnology R&D center (C)..... Feb 23
Sovitex, joint venture between Italian and Soviet engineering firms (N) .... June 66H


# S


**Safety**
AIChE's instructional videotapes on chemical process safety (C) ..... May 21
Chemical Process Safety Management Conference: Chemical process safety must be constantly managed...and sharing information is a good first step toward managing safety effectively (C) ..... Feb 23
Chemical resistance of protective clothing can be evaluated quickly by CPCtest system (C) ..... June 25
City of Torrance, Calif. takes legal action to have Mobil Oil refinery declared a public nuisance (C)..... May 23
Crisis management—Preparation: The key to crisis control. Roy M. Starks, Jr. ..... June *171
DOT rule mandates safety improvements for tank trucks carrying hazardous gases and liquids (C) ..... July 27
Earthquake damages two gasoline storage tanks at Unocal's Richmond, Calif. terminal (N)..... Nov 63
Equipment Focus: New piping systems enter the mainstream ..... May *111
Equipment and services ..... May *112
Manufacturers' literature..... May 122
Equipment Focus: Safety is job one . Apr *107
Equipment and services ..... Apr 107
Manufacturers' literature..... Apr 114
Fire modeling: Hazard I (N)..... Oct 64
Hazardous materials trigger a software explosion. Len Egol ..... Apr *179
Insulation: Calculate insulation thickness for personnel protection. Win Irwin (P.N.) (table) ..... Sept *207
International database of environmental, health and safety regulations (C) . May 25
OSHA
Exposure limits for 428 toxic substances become effective Mar. 1 (C) .... Feb 27
Hazard Communication Standard: Supreme Court to review decision challenging OMB's authority to disapprove information-collection requirements(C)..... July 27
OMB allegedly stalls environmental, safety regulations (C) ..... Dec 25
Pumps: Surging interest in leakproof pumps. Gerald Parkinson & Eric Johnson (N) (diagram) ..... June *30
Choices widen for magnetically driven pumps..... June 35
—Letter ..... Aug 7
—Postscripts, corrections..... Oct 8
Relief valves: Safer relief-valve sizing. Wing Y. Wong (charts, tables, diagram) ..... May *137
—Postscripts, corrections..... Aug 7
Waste disposal: Save money on drum-quantity waste disposal. Stephen A. Tzikas (table) ..... Feb *118
**Salaries**
CPC reports salary offers to B.S.Ch.E.s topped those of all engineers for the first time (C) ..... Mar 17
Engineering salaries: The 1988 report. Nicholas Basta (charts)..... Mar *171
—Correction ..... Apr 7
Engineering salaries: The 1989 report. Nicholas Basta (charts, table) .... Dec 137
Engineering salaries—Letter ..... May 8


NOTES—*Illustrated; (C) Chementator; (Ed) Editor's Page; (N) Newsfront; (P.N.) Plant Notebook; (R) Reprints available

Starting salary offers to B.S.Ch.E.s are up 6.3% since last year (C) ..... Aug 9

**Salt**

German process removes waste salts from desulfurization washwater (C) .... Sept 21
Recycling salt slag from aluminum manufacturing in Italy (C) ..... Sept 23
Salt-purification system with one-fourth the energy costs (C) ..... Aug 9
Saudi Arabia—Reverse osmosis plant: a way to reduce the cost of water desalination will get its first application (C) ..... Feb 21

**Scrubbers**

Duct injection may be an alternative to scrubbing in existing power plants (C) ..... Feb 23
'Foam scrubbing' may control toxic-gas releases (C) ..... Sept 17
Preventing corrosion in stacks and scrubbers. V. Ganapathy (P.N.) (diagrams) ..... Jan 152
Scrubber eliminates ethylene oxide (P.N.) ..... Dec *153

**Seals**

Centrifugal pumps—report (charts, tables, diagrams) ..... July *96
Better seals will boost pump performance. Raymond Battilana .... July *106
—Postscripts, corrections ..... Sept 8
Changes in pump design can reduce seal failures. Richard Antkowiak ..... May *173
Dry seal keeps pharmaceuticals clean (P.N.) ..... June *182
Equipment Focus: Seals and packings ..... June *99
Equipment and services ..... June *99
Bigger and better seals and bearings handle diverse applications ... June *101
Selling—Videotapes: It's *fast forward* for CPI videomakers. Susan Irving-Monshaw (N) ..... Oct *37

**Separation**

Abrasion-resistant ceramic membranes being evaluated as media to separate pollutants from high-temperature gases (C) ..... Jan 25
Crossflow microfilters: The ins and outs—report. Stephen L. Michaels (diagrams, tables) ..... Jan *84
—Letters ..... July 8
Electroacoustic dewatering can offer energy savings (C) ..... May 23
Equipment Focus: Broader options enhance solid-liquid separations ... June *151
Equipment and services ..... June *151
Manufacturers' literature ..... June 158
A larger centrifuge separates more materials in less time for Dow (P.N.) ..... Jan *149
Magnetic wastewater-treatment process meets phosphate-emission standards (C) ..... June 17
Membranes: The new actors in liquid separations (N) ..... Dec *37
Novel separator, combining ultrafiltration membranes with centrifugal action, makes its debut at California food processor. Gerald Parkinson (N) ..... Jan 44
Olefins-separation process offers lower costs and higher capacities for ethylene plants (C) ..... Aug 15
Separating oil-water emulsions by electrocoagulation may be cheaper (C) ... Jan 19
Supercritical processes win CPI acceptance. Gerald Parkinson & Eric Johnson (N) ..... July *35
Synthesize simple distillation the thermodynamic way—report. David Trigueros & others (tables, diagrams) ..... Aug 129
UC's VPSA: Gas-separation technology boasts lower costs (C) ..... Oct 17
Unocal's continuous chromatographic separation system (N) ..... May 48
Shelton, James of Dow Chemical: Getting it right the first time. Sandy Edwards .. Jan *49

**Shipping**

Hazardous materials
DOT rule mandates safety improvements for tank trucks carrying hazardous gases and liquids (C) ... July 27
Hazardous wastes
Keeping tabs on the world's wastes: framework to regulate international shipments established. Eric Johnson (N) ..... Apr 48E
Sieve Trays—A new correlation for sieve trays. Thomas J. Ward (P.N.) (graphs) ..... June 177

**Simulation**

Aspen hits Europe (N) ..... Jan 48H
—Letter ..... Apr 7
Dynamic simulation: Accelerating interest in dynamic simulation. David Hunter & others (N) ..... Feb *30
Dynamic simulation: A once exclusive club (Ed) ..... Feb 5
Simulation and process control. Len Egol ..... Feb *161
—Letter ..... July 8
Smart process simulator makes its debut (C) ..... Oct 25

**Sizing**

Safer relief-valve sizing. Wing Y. Wong (charts, tables, diagram) ..... May *137
—Postscripts, corrections ..... Aug 7
Sizing the economic pipe. Byron D. Smith ..... Sept *201
Smith, Bryan of ICI—The priority of engineering. Eric Johnson ..... Aug *59
Society of Mining Engineers—Symposium on biotechnology: Varied technical menu at metals meeting. Gerald Parkinson (N) ..... Apr 52

**Soil Treatment**

Europe's ground cleanup: Answers surface for Europe's underground woes. Eric Johnson (N) (charts) ..... June *47
KPEG process for cleaning up PCB-tainted soil achieves 99.8% removal of PCBs in field tests (C) ..... July 21
Waste-site decontamination by a new in situ radio-frequency process from Weston (C) ..... June 17
Solar Power—Detoxifying wastes: Sunny wastes at DOE's Annual R&D Review of Solar Thermal Technology. Gerald Parkinson (N) ..... Mar 60

**Solids**

Boon for solids handling: Agglomeration. Gerald Parkinson (N) ..... Aug *37
Equipment Focus: Broader options enhance solid-liquid separations ... June *151
Equipment and services ..... June *151
Manufacturers' literature ..... June 158
Equipment Focus: Clean outlook for solids handling ..... Nov *163
Manufacturers' literature ..... Nov 171
Massflow measurement of solids in pneumatic conveying units is possible with GranuCor (C) ..... June 19
Powder & Bulk Solids Conference & Exhibition—Preview: New product highlights ..... Apr *71

**Solvents**

First commercial use of absorption in a solvent-recovery application in West Germany (C) ..... Mar 17
Flush away equipment problems. Richard P. Palluzi (table, graphs, diagrams) Jan *104
Salt-purification system with one-fourth the energy costs is solvent-extraction route (C) ..... Aug 9
Solvent unit cleans synthesis gas. R.J. Hernandez & T.L. Hu[illegible]deman (P.N.) (tables) ..... Feb 154
Supercritical-fluid chromatography could cut solvent costs five-to-ten-fold (C) Mar 17
UC system in which supercritical $CO_2$ replaces hydrocarbon solvents could reduce emissions of volatile organic compounds from paints by 30-70% (C). Aug 11
Zeolite out-performs activated carbon in solvent removal at Swedish painting facility (C) ..... Nov 17

**South Africa**

Fischer-Tropsch reactor, costing 30-40% less than conventional units, being started up at Sasol complex (C) ..... Apr 19
Process to recover gallium from ore dusts being tried out (C) ..... Feb 19

**Space Technology**

Humans will inhabit the moon and synthetic planets in the 22nd century: engineers give guesstimates of technology advances 111 years from now (C) . Mar 23
Metallurgical Processes for the Year 2000—production of metals on the moon: Varied technical menu at metals meeting. Gerald Parkinson (N) ... Apr 54
Protein crystals grown on the Space Shuttle may lead to new drugs (C) .... Apr 21
3M space processing tests on polymeric materials may have down-to-Earth benefits (C) ..... Nov 27

**Spectrometry**

Mass spectrometer designed for online ammonia production analysis and optimization (C) ..... Apr 21
NIST researchers develop more-sensitive way to analyze substances for ICP-MS technique (C) ..... Mar 25
X-ray fluoroscope helps copper platers (P.N.) ..... Apr *176
Sponge—Forager sponge absorbs heavy metal pollutants (C) ..... Sept 21
—Postscripts, corrections ..... Nov 8
Spreadsheets see **Computers**—Software; **Mathematics**
Stacks—Preventing corrosion in stacks and scrubbers. V. Ganapathy (P.N.) (diagrams) ..... Jan 152

**Standards**

ASME Boiler and Pressure Vessel Code is going electronic (C) ..... May 19
California diesel fuel gets stricter standards. Gerald Parkinson (N) ..... Jan 42
Centrifugal pumps—report (charts, tables, diagrams) ..... July *96
Better standards, better pumps. Paul T. Lahr ..... July *96
Coming soon: New ANSI pump standard. John A. Reynolds ..... July *98
Now here: Revised API pump standard. John W. Dufour ..... July *101
Better seals will boost performance. Raymond E. Battilana ..... July *106
—Postscripts, corrections ..... Sept 8
Compatibility is the buzzword on the plant floor (Ed) ..... Nov 5
OSHA's Hazard Communication Standard see **Occupational Safety & Health Administration**
A reliable base for high-nickel equipment. James L. Gossett (tables) ..... May *145
Statistics—Multiple regression: Harnessing the power of multiple regression. Dennis E. Johnson (chart, tables) ..... Nov 176

**Steam**

Cogeneration see **Generators**
Equipment Focus: Steam traps ..... Oct *117
Manufacturers' literature ..... Oct 122
Steam cleaning for dirty soil (P.N.) . May *180

**Steam Reforming**

Heat-pipe reformer design may result in units that are 30% more efficient (C) Apr 17
Silberring looking for a hydrogen user to demonstrate a novel steam reformer (C) ..... Feb 17
Steam Traps—Equipment Focus ..... Oct *117
Manufacturers' literature ..... Oct 122

**Steel**

Energy savings of about 20% may be possible via direct steelmaking in AI&SI process (C) ..... June 23
Nitrate wastewater emissions from steel pickling are eliminated by recycling process from Germany (C) ..... Aug 15
Steel industry may benefit from two ultrasonic technologies (C) ..... Jan 19
Steelmaking slurries: A collective method cleans up steelmaking slurries (C) Sept 17
Stewart, Richard of Du Pont—The kind of guy you trust. Sandy Edwards ..... Feb *55

**Storage**

Storage containers stack up savings (P.N.) ..... Aug *175
Underground storage tanks: Industry lags in complying with tank law (C) ... Dec 25
Stripping—Steam cleaning for dirty soil (P.N.) ..... May *180


NOTES—*Illustrated; (C) Chementator; (Ed) Editor's Page; (N) Newsfront; (P.N.) Plant Notebook; (R) Reprints available

Sugar—Substitutes: New sugar substitutes are poised to hit the table. Susan Irving-Monshaw (N) (tables) ..... July 47
Sulfur—Desulfurization see **Desulfurization**
**Sulfur Dioxide**
Combustion Engineering developing way to eliminate $SO_2$ via radiation with high-energy electrons (C) ..... Feb 25
German route for removing $SO_2$ after calcining of $TiO_2$ creates no added wastes (C) ..... May 21
'Hot' technique measures $SO_2$ in stack gas (C) ..... Oct 21
**Sulfur Oxide**
De-$SO_x$ process, claimed to be cheaper than conventional methods, undergoing pilot tests at Gagliri (C) ..... June 21
FERC's process: One shot socks $SO_x$ and $NO_x$ (C) ..... Nov 25
Noxso process that removes both $NO_x$ and $SO_x$ begins pilot-scale tests (C) .. June 21
**Sulfuric Acid**
Bayer-Sulzer-Escher Wyss patent battle over sulfuric-acid-recycle process (N) Jan 39, (C) ..... Apr 23
—Letter ..... May 7
A shortcut technique for finding $H_2SO_4$ concentration. C.M. Davidson (P.N.) (table) ..... Mar 185
**Superconductivity**
Du Pont and Oak Ridge join to increase current carrying capacity of superconductors (N) ..... Oct 68G
Lawrence Berkeley Laboratory develops new process for making high-temperature superconductors (N) ..... Feb 48E
Mitsui to commercialize a high-temperature superconductor (C) ..... Nov 21
A "production-scale" superconducting-thin-film machine—the world's first (C) ..... May 19
Triple collaboration on superconductivity research: Du Pont, Hewlett-Packard and Los Alamos National Laboratory (C) ..... July 23
Wayne State researchers find superconductors do better in an oxygen environment (C) ..... Nov 23
**Supervision**
Training: Make training more than a stepchild. Robert W. Gallant ..... Aug *161
The winning edge in negotiations. Robert W. Gallant ..... Nov *229
Surfactants—Surfactants: Important tools in chemical processing. A.P. Kouloheris (diagrams, graph, tables) ..... Oct 130
**Sweden**
A sound method for degreasing metal parts (C) ..... Oct 23
Zeolite out-performs activated carbon in solvent removal at Swedish painting facility (C) ..... Nov 17
Sweeteners—New sugar substitutes are poised to hit the table. Susan Irving-Monshaw (N) (tables) ..... July 47
**Switzerland**
Heavy-metals-laden flyash can be landfilled after stabilization by a process that will debut at Hinwil (C) .... June 19
Sandoz AG's electrochemical copper-removal process from dye-making wastes boasts savings (C) ..... Apr 17
Silberring looking for a hydrogen user to demonstrate a novel steam reformer (C) ..... Feb 17
Two-stage de-$NO_x$ route that injects urea and methanol removes 65-80% of nitrogen oxides from fluegas (C) ..... July 19
**Synthesis**
Australian microwave 'factory' speeds synthesis of chemical compounds (C) . Nov 17
Making organic chemicals via electrochemical processing. Joseph E. Toomey, Jr. & Jimmy C. Yu (charts, tables, diagrams) ..... June *140
—Postscripts, corrections ..... July 10
Methanol via methyl formate synthesis appears commercially promising (C) ..... May 21
Synthesize simple distillation the thermodynamic way—report. David Trigueros & others (tables, diagrams) ..... Aug 129


# T


**Tanks**
Draining tanks: How long does it really take? Mahnoosh Shoaei & Jude T. Sommerfield (P.N.) (diagram) ..... Jan 154
How to purge small vessels with nitrogen. William A. Levinson (P.N.) (chart) ..... Nov 249
Russians licensing method of speeding up construction of storage tanks (N) ..... Dec 48D
Tracer-based test for locating tank leaks as small as 0.0004 gal/h available from Tracer Research (C) ..... June 19
Underground storage tanks: Industry lags in complying with tank law (C) ... Dec 25
Tar Sands—Minerals, as well as petroleum, may be recovered from Canadian tar sands through Solv-Ex process (C) ..... Apr 17
**Taxation**
Chlorofluorocarbons could become more expensive to use with new tax proposal under consideration (C) ..... Aug 19
House approves taxes on CFCs, crude oil (C) ..... Nov 27
Tax, don't ban, CFCs—Letter ..... Aug 7
**Technology**
Engineers give guess-timates of technology advances 111 years from now (C) ..... Mar 23
Technology: a mixed perception—INIFES survey analysis (C) ..... Sept 23
Television—It's *fast forward* for CPI videomakers. Susan Irving-Monshaw (N) .. Oct *37
**Temperature**
Belt cooler: get more out of your belt cooler. Per Lindén (graphs, table) ..... Sept 170
Boiling point gives critical temperature. Charles H. Fisher (tables) ..... Mar 157
How to predict batch-reactor heating and cooling. John McEwan (P.N.) ..... May 179
Preventing corrosion in stacks and scrubbers. V. Ganapathy (P.N.) (diagrams) ..... Jan 152
**Testing**
Chemical resistance of protective clothing can be evaluated quickly by CPCtest system (C) ..... June 25
Field testing
North Carolina law that allows the state to veto field testing of genetically engineered organisms getting mixed reviews from biotech industry (C) ..... Sept 27
Mobile lab provides on-the-spot testing (P.N.) ..... Mar *188
Moisture content: Two ways to check moisture content. Nigel P. Brown (P.N.) ..... Aug *173
Nondestructive testing in the CPI—CE Refresher. Frank J. Sattler (charts. diagrams)
Part 1: Improving quality through nondestructive testing ..... Apr *116
Part 2: Finding surface defects with nondestructive testing ..... July *125
Part 3: Finding below-surface defects with nondestructive testing .... Sept *161
Part 4: Nondestructive testing via optical and acoustical methods ..... Nov *191
Part 5: Improving plant maintenance via nondestructive testing ..... Dec *59
Tracer-based test for locating tank leaks as small as 0.0004 gal/h available from Tracer Research (C) ..... June 19
Textiles—Baghouses: A hot and dirty future for baghouses. Gerald Parkinson (N) ..... Apr *30
—Postscripts, corrections ..... June 8
—Letter ..... Sept 8
Thermal Conductivity—Wayne State's thermal wave technique measures thermal conductivity of diamond films (C) ... Nov 21
Thermal Power—Detoxifying wastes: Sunny outlook at DOE's Annual R&D Review of Solar Thermal Technology. Gerald Parkinson (N) ..... Mar 60
Thermodynamics—Synthesize simple distillation the thermodynamic way—report. David Trigueros & others (tables, diagrams) ..... Aug 129
Thermoforming—Plastics: From pellets to products. Dale E. Witwer (diagrams) Sept *123
**Thermoplastics**
Autos set a face pace for thermoplastics. Benno Groeneveld (N) (tables).... Feb 35
Recycled plastics could improve concrete (C) ..... Sept 25
Thermoplastic heat exchangers offering lower maintenance costs (C)..... Apr 19
**Thin Film**
Diamonds catch the CPI's eye. Jayadev Chowdhury (N) ..... Sept *48
Japan's NIRIM improves conventional deposition method (C) ..... Nov 21
A "production-scale" superconducting-thin-film machine—the world's first (C) ..... May 19
UCLA process: Leveling out the rough spots on diamond films (C) ..... Nov 21
Wayne State's thermal wave technique measures thermal conductivity of diamond films (C) ..... Nov 21
Tin—Tin-based molecule may form new polymers (C) ..... Sept 23
Tishler, Max (obituary May p.65)—Tishler, USDA, pencillin—Letter ..... July 10
**Titanium Dioxide**
Bayer-Sulzer-Escher Wyss patent battle over sulfuric-acid-recycle process (N) Jan 39, (C) ..... Apr 23
—Letter ..... May 7
German route for removing $SO_2$ after calcining of $TiO_2$ creates no added wastes (C) ..... May 21
A good credo to live by (Ed) ..... Jan 5
$TiO_2$'s future is keyed to new technologies. Lisa Lazorko & others (N) (tables) .Jan *37
—Letter ..... May 7
Toluene—Mobil R&D's disproportionation of toluene into benzene wins Kirkpatrick Honor Award (C) ..... Oct 19
Mobil selective toluene disproportionation—Kirkpatrick Honorable Mention (diagram) ..... Dec *83
**Training**
AIChE's instructional videotapes on chemical process safety (C) ..... May 21
Continuing education: How to stay current. Stanley M. Englund (table)... Jan *143
Make training more than a stepchild. Robert W. Gallant ..... Aug *161
Videotapes: It's *fast forward* for CPI videomakers. Susan Irving-Monshaw (N) ..... Oct *37
**Trichloroethylene**
"Biostimulation" test by Stanford: bugs feast on vinyl chloride and other goodies (C) ..... Nov 25
Combustion Engineering plans trichloroethylene cleanup (C) ..... Dec 17
Stimulated bugs guzzle up TCE (C) . Nov 25
Trobaugh, Benson of Merck—How do you stay competitive? Sandy Edwards .. May *57
Trucks—DOT rule mandates safety improvements for tank trucks carrying hazardous gases and liquids (C) ..... July 27
**Tubes & Tubing**
Inserts that improve tubeside heat transfer up to five times in gas streams (C) ..... Jan 17
Westinghouse computer figures out a better way to make metal tubes (N) . Dec 48D
**Turbines**
Cogeneration's burning bright. Jayadev Chowdhury & others (N) ..... June *39
Gas-turbine combined cycle may generate electricity more efficiently (C) .... Apr 23
Solar Turbines program aimed at reducing $NO_x$ emissions from a diesel-fueled industrial turbine (N) ..... Aug 55


NOTES—*Illustrated; (C) Chementator; (Ed) Editor's Page; (N) Newsfront; (P.N.) Plant Notebook; (R) Reprints available

# U

**Ultrasonics**
Steel industry may benefit from two ultrasonic technologies (C) ..... Jan 19
Sweden: A sound method for degreasing metal parts (C) ..... Oct 23
U.S. Dept. of Energy—Watkins, James is President Bush's choice to head DOE (C) ..... Feb 27
Urea—Two-stage de-$NO_x$ route injects urea and methanol (C) ..... July 19

# V

Vacuum—Gages: Select the right vacuum gage. L.L. Roper & J.L. Ryans (charts, tables, nomograph, diagrams) ..... Mar *125
**Valves**
Equipment Focus: Spotlighting valves Jan *71
Equipment and services ..... Jan *71
Manufacturers' literature ..... Jan 76
Equipment Focus: Valves seek higher performance levels ..... May *153
Product developments ..... May *154
Manufacturers' literature ..... May 162
Equipment Focus: Valves—Small equipment that adds up to a big investment ..... Sept *133
Manufacturers' information ..... Sept 142
High-nickel-alloy valves: A reliable base for high-nickel equipment. James L. Gossett (tables) ..... May *145
Safer relief-valve sizing. Wing Y. Wong (charts, tables, diagram) ..... May *137
—Postscripts, corrections ..... Aug 7
**Vapor Deposition**
Japan's NIRIM improves conventional deposition process (C) ..... Nov 21
Laser-based chemical-vapor-deposition process makes ceramic fibers (C) . July 17
UCLA process: Leveling out the rough spots on diamond films (C) ..... Nov 21
Vibration—Confessions of a service engineer. George R. Kent
Part I: Troubleshooting vibration problems ..... Feb *145
Part II: Troubleshooting rotating equipment ..... Apr *163
Part III: Troubleshooting equipment vibration ..... July *171
Videotapes—It's *fast forward* for CPI videomakers. Susan Irving-Monshaw (N) .. Oct *37
Vinyl Chloride—"Biostimulation" test by Stanford: bugs feast on vinyl chloride and other goodies (C) ..... Nov 25
Vinyls—European Vinyls Corp. acquires the vinyls technology and licensing business of Stauffer from ICI Americas (N) .. Feb 48F
Vitrification—Ash-minimization process has a 'constructive' side (C) ..... Oct 17

# W

**Waste Disposal**
Antitrust dispute over alleged predatory pricing in the waste-disposal market involving Browning-Ferris to be reviewed by Supreme Court (N) ..... Jan 48
Automated waste recovery cuts materials and disposal costs (P.N.) ..... Jan *150
EPA adds to restrictions on hazardous-waste disposal (C) ..... Dec 27
Flyash can make clay landfill-liners better barriers to organic contaminants (C) ..... Aug 17
Geologic repository for the long-term disposal of hazardous wastes in a salt dome (C) ..... July 21
Heavy-metals-laden flyash can be landfilled after stabilization by a process that will debut in Switzerland (C) June 19
International shipments framework established: Keeping tabs on the world's wastes. Eric Johnson (N) ..... Apr 48E
Landfills may provide safe treatment for some toxic wastes (C) ..... Jan 21
Lined landfill takes incinerator ash: polyethylene liner at Shrewsbury, Mass. (P.N.) ..... Mar *186
Mining concerns are fighting EPA's attempts to regulate mineral processing wastes (C) ..... June 27
Plastics: Banning plastics is not the way to solve solid-waste problems (C) ... June 25
Plastics: degradable vs. recyclable plastics' clash is brewing in Congress (C) ..... Mar 25
Save money on drum-quantity waste disposal. Stephen A. Tzikas (table) .. Feb *118
Superfund
Superfund money should come from surcharges on insurance premiums (C) ..... Mar 27
OTA report lambasts Superfund work. Reginald Rhein (N) ..... Mar 58
SARA's slip is showing (Ed) ..... Apr 5
Environmental indicators should be used to measure Superfund's success (C) ..... June 27
Cleaning up contaminated waste sites—report. David R. Hopper (map, tables, flowsheets, diagrams) (R) ..... Aug *94
—Letters ..... Nov 8
Fixing Superfund. Dennis Melamed (N) (charts) ..... Nov *30
$TiO_2$'s future is keyed to new technologies. Lisa Lazorko & others (N) (tables) .Jan *37
—Letter ..... May 7
U.S. needs a national policy for municipal solid waste—OTA report (C) ..... Dec 27
Waste Disposal See also **Incineration**
Waste Exchange—Moving closer to nationwide waste exchange (C) ..... Oct 21
**Waste Management**
DOE awards contract to manage nuclear-waste to a consortium (C) ..... Jan 27
International pact governing the import and export of hazardous wastes expected to get U.S. approval (C) ..... July 27
Recycling solid wastes (Ed) ..... July 5
Save money on drum-quantity waste disposal. Stephen A. Tzikas (table) .. Feb *118
**Waste Minimization**
AIChE forms a Center for Waste Reduction Technologies (C) ..... Dec 25
Cleaning up contaminated waste sites—report. David R. Hopper (map, tables, flowsheets, diagrams) (R) ..... Aug *94
Waste minimization—preventing tomorrow's remediation problems .... Aug 110
—Letters ..... Nov 8
EPA establishes a Pollution Prevention Office (C) ..... Feb 27
Save money on drum-quantity waste disposal. Stephen A. Tzikas (table) .. Feb *118
U.S. needs a national policy for municipal solid waste—OTA report (C) ..... Dec 27
**Waste Treatment**
Allied-Signal's electrodialytic bipolar-membrane technology wins Kirkpatrick Honor Award (C) ..... Oct 19
Allied-Signal Aquatech acid recovery system—Kirkpatrick Honorable Mention ..... Dec *81
Ash-minimization process has a 'constructive' side(C) ..... Oct 17
Automated waste recovery cuts materials and disposal costs (P.N.) ..... Jan *150
Bend Research membrane system for removing organic contaminants from waste streams (N) ..... Feb 48E
California into site remediation—Letter ..... Aug 7
Carbonaceous wastes can be gasified without environmental problems with Skygas process (C) ..... July 21
Catalysts: Designer catalysts are all the rage. Gerald Parkinson & Eric Johnson (N) ..... Sept *30
—Letter ..... Dec 7
Circulating-bed combustion system being evaluated to clean up McColl Superfund site in Calif. (N) ..... Jan 23
Cleaning up contaminated waste sites—report. David R. Hopper (map, tables, flowsheets, diagrams) (R) ..... Aug *94
—Letters ..... Nov 8
DCH route, new way to detoxify liquid organic wastes, proposed for central hazardous-waste-treatment facility in the Netherlands (C) ..... Aug 11
DOE's INEL begins first full-scale incineration of nuclear and non-nuclear mixed wastes (C) ..... Mar 19
Detoxifying wastes: Sunny outlook at DOE's Annual R&D Review of Solar Thermal Technology. Gerald Parkinson (N) ..... Mar 60
Electroacoustic dewatering can offer energy savings for those who dry sewage sludge prior to burning or disposal (C) ..... May 23
EPA shuns the Energy Dept.'s nuclear cleanup plan (C) ..... Sept 27
EPA will license three mobile waste-treatment technologies to the private sector (N) ..... Jan 48
Europe's ground cleanup: Answers surface for Europe's underground woes. Eric Johnson (N) (charts) ..... June *47
German process that could clean up chlorinated wastes at 1/3 to 1/2 the cost of incineration will debut in mobile unit (C) ..... Feb 17
German route for removing $SO_2$ after calcining of $TiO_2$ creates no added wastes (C) ..... May 21
Heavy-metals-laden flyash can be landfilled after stabilization by a process that will debut in Switzerland (C) June 19
A just-patented conveyor furnace for waste treatment is more cost-effective (C) ..... Apr 21
Landfills may provide safe treatment for some toxic wastes (C) ..... Jan 21
Liquefied-gas solvent-extraction process for waste treatment (C) ..... July 19
Mobile remediation system gets California permit (N) ..... Aug 55
Oil spills: Experimental technology for oil spill containment and recovery (OSCAR) being tested in Valdez, Alaska (C) May 17
Oxidizing wastes electrochemically: U.K.'s AEA process (C) ..... Sept 17
PCBs
GF successfully employs biodegradation for destroying PCBs in contaminated river sediments (N) ..... Dec 48D
KPEG process for cleaning up PCB-tainted soil achieves 99.8% removal of PCBs in field tests (C) ..... July 21
New bacteria destroy PCBs in a single step (C) ..... Sept 21
Onsite or offsite reprocessing of PCBs: which is better? (N) ..... Aug 56D
Portable waste analyzer gives immediate results (C) ..... Oct 19
Preussag process cuts waste-sludge volume from ore leaching by about 80% (C) ..... Aug 11
Steelmaking slurries: a collective method cleans up steelmaking slurries (C) Sept 17
Superfund see **Waste Disposal**—Superfund
Waste-site decontamination by a new in situ radio-frequency process from Weston (C) ..... June 17
**Waste Utilization**
Ash-minimization process has a 'constructive' side (C) ..... Oct 17
Australia's Neutralysis' novel way of making light aggregate uses wastes as fuel and a feedstock (C) ..... May 25
Automated waste recovery cuts materials and disposal costs (P.N.) ..... Jan *150
Building material can be made from waste gypsum in new German route (C) . Aug 13
China: Red carpet welcome for U.S. waste paper. Reginald Rhein (N) ..... Mar 64E
Coal ash may offset acid rain damage: new West German compound (C) ..... Dec 19


NOTES—*Illustrated; (C) Chementator; (Ed) Editor's Page; (N) Newsfront; (P.N.) Plant Notebook; (R) Reprints available

Garbage plant makes fuel instead of landfill fodder (C) ..... Nov 19
German route converts liquefied dung to environmentally acceptable fertilizer (C) ..... Apr 23
Meat: More-efficient meat processing (N) ..... Sept 69
Oilfield waste can be converted to a clean fuel via gasification (C) ..... Apr 23
Phosphate waste could be converted to phosphoric acid with USBM process (C) ..... Mar 21
Potato waste turned into biodegradable plastics (C) ..... Sept 19
Preussag process cuts waste-sludge volume from ore leaching by about 80% (C) ..... Aug 11
Process to recover CFCs from ethylene oxide sterilant (C) ..... Jan 23
Recycling
Bayer-Sulzer-Escher Wyss patent battle over sulfuric acid-recycle process (N) Jan 39, (C) ..... Apr 23
—Letter ..... May 7
Degradable vs. recyclable plastics clash is brewing in Congress (C) ..... Mar 25
Du Pont and Waste Management link up for plastics recycling (C) ..... May 19
German recycling process removes waste salts from desulfurization washwater (C) ..... Sept 21
Nitrate wastewater emissions from steel pickling are eliminated by recycling process from Germany (C) Aug 15
Plastics recycling picks up momentum. Nicholas Basta & Eric Johnson (N) (chart) ..... July *30
Polystyrene: first recycling of used polystyrene in the U.S. will begin next month (C) ..... Jan 21
Railroad ties: What do you do with old railroad ties? (C) ..... Oct 21
Recycled plastics could improve concrete (C) ..... Sept 25
Recycling solid wastes (Ed) ..... July 5
Salt slag recycled from aluminum manufacturing in Italy (C) ..... Sept 23
Sludge and ash are combined to make construction material (C) ..... Dec 23
Sandoz AG's electrochemical copper-removal process from dye-making wastes boasts savings (C) ..... Apr 17
Sludge-to-fuel process competes with landfilling in W. Germany (C) ..... Nov 19
South Africa: process to recover gallium from ore dusts being tried out (C) Feb 19
Sponge absorbs heavy-metal pollutants (C) ..... Sept 21
—Postscripts, corrections ..... Nov 8
Triple-effect evaporator aids in byproduct recovery at Jack Daniel Distillery (P.N.) (flowchart) ..... Nov *259
USBM process could produce graphite flake at a fraction of the current cost (C) ..... June 17

**Water Pollution**

Czech antipolution drive picks up speed. Eric Johnson (N) ..... Oct 62
GE successfully employs biodegradation for destroying PCBs in contaminated river sediments (N) ..... Dec 48D
Nitrate wastewater emissions from steel pickling are eliminated by recycling process from Germany (C) ..... Aug 15
Oil spills
Experimental technology for oil spill containment and recovery (OSCAR) being tested in Valdez, Alaska (C) ..... May 17
Native microorganisms being tested for cleaning up the oil spill in Prince William Sound, Alaska (C) ..... July 25
Paper mill study: No paper tiger (Ed) ..... Mar 5
Paper mill study: Dioxin found in fish and wastewater downstream from paper mills (C) ..... Apr 27
61 cities cited for toxic wastewater violations (C) ..... Nov 27
$TiO_2$'s future is keyed to new technologies. Lisa Lazorko & others (N) (tables) Jan *37
—Letter ..... May 7
Trichloroethylene cleanup see **Trichloroethylene**

**Water Supply**

Drinking water
Diesel fuel: a new source of drinking water (C) ..... Dec 21
U.K.: Privatization triggers new challenges for U.S. chemical firms. Herbert Short (N) (tables) ..... Jan *30

**Water Treatment**

Bacteria: Stimulated bugs guzzle up TCE (C) ..... Nov 25
Befs crystallization process is a lower-energy, zero-discharge method of treating coke-oven wastewater (C) ..... Mar 19
"Biostimulation" test by Stanford: bugs feast on vinyl chloride and other goodies (C) ..... Nov 25
BOM biological technique for removing metal contaminants from wastewater: Varied technical menu at metals meeting. Gerald Parkinson (N) ..... Apr 52
Cleaning up contaminated waste sites—report. David R. Hopper (map, tables, flowsheets, diagrams) (R) ..... Aug *94
—Letters ..... Nov 8
CNCProcess: Cyanide is completely converted to $CO_2$ and inorganic nitrogen (C) ..... Mar 17
Desalting
Saudi Arabia's RO plant: a way to reduce the cost of water desalination will get its first application (C) ..... Feb 21
Equipment Focus: Cooling-water treatment—Taking the guesswork out of water treatment ..... Apr *147
Equipment and services ..... Apr 150
Equipment Focus: Water and wastewater treatment—A thriving business .. Dec *85
Equipment and services ..... Dec 86
Evaporate and crystallize waste brines. Dennis Anthony (tables, flowchart) Apr *138
—Letters ..... July 8
German recycling process removes waste salts from desulfurization washwater (C) ..... Sept 21
Magnetic wastewater-treatment process meets phosphate-emission standards (C) ..... June 17
Nitrate wastewater emissions from steel pickling are eliminated by recycling process from Germany (C) ..... Aug 15
Non-chromates vie for a cooling water niche. Susan Irving-Monshaw (N) Sept *59
Novel separator, combining ultrafiltration membranes with centrifugal action, makes its debut at California food processor. Gerald Parkinson (N) ..... Jan 44
Process for treating effluents—45-75°C, vs.25-35°C for methods using conventional microorganisms—will be tested at Kuwaiti complex (C) ..... July 19
Removal of heavy metals from wastewater—with guaranteed performance—offered by Tetra (C) ..... June 23
Sponge absorbs heavy metal pollutants (C) ..... Sept 21
—Postscripts, corrections ..... Nov 8
Steam cleaning for dirty soil (P.N.) . May *180
Supercritical process for waste-destruction goes commercial (C) ..... Dec 23
Ultrox process combining radiation and oxidation may reduce toxic-organics levels in wastewater (C) ..... Apr 19
Wastewater treatment unit, ISEP, closes the ammonium loop (P.N.) ..... Oct *197
Wear Rings—Keep the wear out of pump wear rings. Colin McCaul ..... Oct *149
Weather—Bush maps out a plan for global climate research (C) ..... Oct 27
Weighing—Equipment Focus: Electronics aid bulk materials handling ..... Sept *179
Manufacturers' literature ..... Sept 189
—Letter ..... Nov 8
Wetting Agents—Surfactants: Important tools in chemical processing. A.P. Koulouheris (diagrams, graph, tables) ..... Oct 130
Wind—Russians generating electric power with small size windmills (N) ..... Dec 48D
Women—Women engineers: The playing field isn't level. Suzanne Shelley (N). Dec *47
Writing—Make your writing stand out. David E. Nadziejka ..... Aug *147


## X


X-Rays—X-ray fluoroscope helps copper platers (P.N.) ..... Apr *176
Xylene—Mobil R&D's disproportionation of toluene into benzene wins Kirkpatrick Honor Award (C) ..... Oct 19
Mobil selective toluene disproportionation—Kirkpatrick Honorable Mention (diagram) ..... Dec *83


## Y


Yandle, Gerald of Hercules—Adapt to change. Sandra Edwards ..... Dec 51

**You & Your Job**

Calculate your job enjoyment. John Gillett ..... June *164
Change jobs or stay put? Eugene Raudsepp (job satisfaction inventory questionnaire) ..... June *161
Engineering salaries: The 1988 report. Nicholas Basta (charts) ..... Mar *171
—Correction ..... Apr 7
Engineering salaries: The 1989 report. Nicholas Basta (charts, table) .... Dec 137
How to speak so facts come alive. Morey Stettner ..... Sept *195
How to stimulate the innovation process. Walter J. Eldredge ..... July *187
Make your writing stand out. David E. Nadziejka ..... Aug *147
Photography in engineering. Harold W. Russell
Part 1: Applications ..... Jan *137
—Letters ..... Apr 7
Part 2: Equipment (Be a photographic engineer) ..... Feb *137
The 'rights' of management. Jerry O. Dalton ..... Oct *173
The total system of job search. Kenneth & Sheryl Dawson
Part 1: Résumés ..... Apr *158
Part 2: Reference-building, networking, interviewing, negotiating ..... May *165
The winning edge in negotiations. Robert W. Gallant ..... Nov *229


## Z


Zeolites—Zeolite out-performs activated carbon in solvent removal at Swedish painting facility (C) ..... Nov 17


# AUTHOR INDEX


Antkowiak, Richard
Changes in pump design can reduce seal failures ..... May *173
Anthony, Dennis
Evaporate and crystallize waste brines ..... Apr *138
Barnicki, Scott D. & James F. Davis
Designing sieve tray columns ..... Oct 140
Part 1: Tray design ..... Oct 141
Part 2: Column design and verification ..... Nov 203
Basta, Nicholas
Ch.E.s are back in high demand: Good times have returned to the employment scene in the U.S. ..... Aug *22
Engineering salaries: The 1988 report Mar *171
Engineering salaries: The 1989 report Dec 137
More bits and bytes for instruments Nov *46


NOTES—*Illustrated; (C) Chementator; (Ed) Editor's Page; (N) Newsfront; (P.N.) Plant Notebook; (R) Reprints available

Papermakers go electronic ..... Mar *30
PCs invade new CPI frontiers ..... Apr *43
Supercomputing gets a foot in the door ..... Dec *30
Basta, Nicholas & Jayadev Chowdhury
Readers rate CPI products (survey results) ..... Oct *104
Basta, Nicholas & Eric Johnson
Plastics recycling picks up momentum ..... July *30
Battilana, Raymond E.
Better seals will boost pump performance ..... July *106
Brown, Nigel P.
Two ways to check moisture content Aug *173
Cangelosi, Joseph V. & T.K. Subramaniam
Predict safe oxygen in combustible gases ..... Dec 108
Correction ..... Jan 1990 8
Chopey, Nicholas P.
The tops in chemical engineering achievement ..... Dec *79
Chopey, Nicholas P. & others
A wealth of information online .... June *112
Chowdhury, Jayadev
Bullish plans for capital spending .... Jan 35
CPI to set a new capital spending record ..... Aug 46
Cleaning up coal's dirty reputation . Mar *39
Cogeneration's burning bright .... June *39
Diamonds catch the CPI's eye ..... Sept *48
Energy prices will rise in the 1990s . Sept 55
Shrinking CPI equipment—no small feat ..... May *31
Chowdhury, Jayadev & Nicholas Basta
Readers rate CPI products (survey results) ..... Oct *104
Cifuentes, L.
Array processors speed up your computer ..... Mar *175
Clement, Robert
Deciding when to use modular construction ..... Aug *169
Condon, Benjamin T.
Engineering workstations improve productivity ..... May *104
Coronado-Velasco, Cristina & others
Synthesize simple distillation the thermodynamic way ..... Aug 129
Dalton, Jerry O.
The 'rights' of management ..... Oct *173
Davidson, C.M.
A shortcut technique for finding $H_2SO_4$ concentration ..... Mar 185
Davis, James F. & Scott D. Barnicki
Designing sieve tray columns ..... Oct 140
Part 1: Tray design ..... Oct 141
Part 2: Column design and verification ..... Nov 203
Dawson, Kenneth & Sheryl
The total system of job search
Part 1: Résumés ..... Apr *158
Part 2: Reference-building, networking, interviewing, negotiating ..... May *165
Driedger, Walter
How to keep track of instruments .. Apr *171
Dufour, John W.
Now here: Revised API pump standard ..... July *101
Durand, Alejandro Anaya
A quick estimate for centrifugal-pump efficiency ..... July 177
Edwards, Sandy
Adapt to change
(Gerald Yandle of Hercules) ..... Dec *51
Don't burn the toast
(Percy Kavasmaneck of UC) ..... Mar *69
Getting it right the first time
(James Shelton of Dow) ..... Jan *49
The goal is flexibility
(Dr. Walter Robb of GE) ..... Oct *71
How do you stay competitive?
(Benson Trobaugh of Merck) ..... May *57
The kind of guy you trust
(Richard Stewart of DuPont) ..... Feb *55
Managing the 'model' plant
(Charles Hunt of Ethyl) ..... Sept *79
Nurturing our best (Lee Gaumer of Air Products and Chemicals) ... Nov *71
The soda ash king
(John Coykendall of FMC) ..... July *65
Understanding customers
(Timothy A. Bonner of Monsanto) June *69
Egol, Len
An armload of process programs ... July *165
Brighten up computer graphics ..... Oct *201
Computers help fill the engineering gap ..... Sept *217
Desktop products for process control ..... Dec *157
Desktop publishing: For dressing up engineers' reports ..... May *185
Hazardous materials trigger a software explosion ..... Apr *179
Programs for almost every problem June *187, ..... Aug *177
Simulation and process control ..... Feb *161
What's new in networking and data acquisition ..... Nov *269
Eldredge, Walter J.
How to stimulate the innovation process ..... July *187
Englund, Stanley M.
Continuing education: How to stay current ..... Jan *143
Fijas, David F.
Getting top performance from heat exchangers ..... Dec *141
Fisher, Charles H.
Boiling point gives critical temperature ..... Mar 157
How to predict *n*-alkane densities ... Oct 195
France, John J. & Mark E. Harrison
Troubleshooting distillation columns
Part 1: Technique and tools ..... Mar *116
Part 2: Packed columns ..... Apr *121
Part 3: Trayed columns ..... May *126
Part 4: Auxiliary equipment ..... June *130
Fuller, Bruce
Signal conditioners: The process-control link ..... Dec 104
Funk, John C. & Larry McAllister
Controlling continuous processes with DCS ..... May 90
Gallant, Robert W.
Make training more than a stepchild Aug *161
The winning edge in negotiations ... Nov *229
Ganapathy, V.
Preventing corrosion in stacks and scrubbers ..... Jan 152
Quick conversion of $NO_x$ and CO emission rates ..... Dec 149
Garg, A.
How to boost the performance of fired heaters ..... Nov 239
Gillett, John
Calculate your job enjoyment ..... June *164
Gómez, José Vincente
Finding the properties of hydrofluoric acid ..... Feb 152
Gomez-Munoz, Alejandro & others
Synthesize simple distillation the thermodynamic way ..... Aug 129
Gossett, James L.
A reliable base for high-nickel equipment ..... May *145
Green, Richard L. & others
The heat-transfer-fluid spectrum ... Feb 90
Groeneveld, Benno
Autos set a fast pace for thermoplastics ..... Feb 35
Grosz-Roell, F. & others
Better absorption? Try a static mixer July *137
Harrison, Mark E. & John J. France
Troubleshooting distillation columns
Part 1: Technique and tools ..... Mar *116
Part 2: Packed columns ..... Apr *121
Part 3: Trayed columns ..... May *126
Part 4: Auxiliary equipment ..... June *130
Hernandez, R.J. & T.L. Huurdeman
Solvent unit cleans synthesis gas ... Feb 154
Hopper, David R.
Cleaning up contaminated waste sites Aug *94
Hughson, Roy V.
More, more, more software ..... Jan *157
Hunter, David
Robust future for Europe's CPI ..... Jan 48F
Hunter, David & others
Accelerating interest in dynamic simulation ..... Feb *30
Huurdeman, T.L. & R.J. Hernandez
Solvent unit cleans synthesis gas ... Feb 154
Irving-Monshaw, Susan
It's *fast forward* for CPI videomakers Oct *37
New sugar substitutes are poised to hit the table ..... July 47
Non-chromates vie for a cooling water niche ..... Sept *59
U.S. CPI read the President's lips .. Mar 56
Irving-Monshaw, Susan & Eric Johnson
Ethylene's riding high ..... May *35
Irving-Monshaw, Susan & Albert Kislin
Lively markets brighten maleic anhydride horizons ..... Mar *35
Irwin, Win
Calculate insulation thickness for personnel protection ..... Sept *207
Johnson, Dennis E.
Harnessing the power of multiple regression ..... Nov 176
Johnson, Eric
Answers surface for Europe's underground woes ..... June *47
Ch.E.s are back in high demand: in Europe, there are going to be more jobs than available graduates ..... Aug *23
Chemical-weapons furor pricks the CPI ..... Mar 47
Competing for EC's 1992 pie ..... Nov *39
Czech antipollution drive picks up speed ..... Oct 62
EC's getting ready now—for 1992 ... Oct *30
Keeping tabs on the world's wastes . Apr 48E
Portugal moves to privatize its CPI . July 52
The priority of engineering (Bryan Smith of ICI) ..... Aug *59
"ROW" spurs growth in manmade fibers ..... Mar 64E
Stellar year for German E & C firms Apr 48
A West German engineer's "open door" policy (Karl Nöthen of Bayer AG) Apr *59
Johnson, Eric & Nicholas Basta
Plastics recycling picks up momentum ..... July *30
Johnson, Eric & Susan Irving-Monshaw
Ethylene's riding high ..... May *35
Johnson, Eric & Gerald Parkinson
Designer catalysts are all the rage . Sept *30
Supercritical processes win CPI acceptance ..... July *35
Surging interest in leakproof pumps June *30
Johnson, Eric & others
Accelerating interest in dynamic simulation ..... Feb *30
Energy prices will rise in the 1990s . Sept 55
$TiO_2$'s future is keyed to new technologies ..... Jan *37
Kearns, Denise
Washington prepares for 1990 ..... Dec 43
Kent, George R.
Confessions of a service engineer
Part I: Troubleshooting vibration problems ..... Feb *145
Part II: Troubleshooting rotating equipment ..... Apr *163
Part III: Troubleshooting equipment vibration ..... July *171
Kislin, Albert & Susan Irving-Monshaw
Lively markets brighten maleic anhydride horizons ..... Mar *35
Koontz, Donald W. & Donald L. May
Planning cuts the cost of retrofitting controls ..... Oct *181
Kouloheris, A.P.
Surfactants: Important tools in chemical processing ..... Oct 130
Lahr, Paul T.
Better standards, better pumps .... July *96
Lapina, Ronald P.
Compressor performance: Key things to remember ..... Aug *122
Larsen, Alvin H. & others
The heat-transfer-fluid spectrum ... Feb 90
Lazorko, Lisa & others
$TiO_2$'s future is keyed to new technologies ..... Jan *27
Levinson, William A.
How to purge small vessels with nitrogen ..... Nov 249
Lindén, Per
Get more out of your belt cooler .... Sept 170
Maugweiler, W. & others
Better absorption? Try a static mixer July *137


NOTES—*Illustrated; (C) Chementator; (Ed) Editor's Page; (N) Newsfront; (P.N.) Plant Notebook; (R) Reprints available

May, Donald L. & Donald W. Koontz
Planning cuts the cost of retrofitting controls ..... Oct *181
McAllister, Larry & John C. Funk
Controlling continuous processes with DCS ..... May 90
McCaul, Colin
Keep the wear out of pump wear rings ..... Oct *149
McEwan, John
How to predict batch-reactor heating and cooling ..... May 179
McGee, Jamie
Selecting chemical defoamers and anti-foams ..... Apr *131
Melamed, Dennis
Fixing Superfund ..... Nov *30
Melamed Dennis & Gerald Parkinson
The debate starts anew on clean air. Aug *31
Melamed, Dennis & others
Cogeneration's burning bright .... June *39
Energy prices will rise in the 1990s . Sept 55
Michaels, Stephen L.
Crossflow microfilters: The ins and outs ..... Jan *84
Miller, John E.
Bucking up reciprocating pump performance ..... Sept *149
Modell, Donald J.
DCS for batch process control..... May *97
Mutsakis, Michael & others
Better absorption? Try a static mixer ..... July *137
Nadziejka, David E.
Make your writing stand out..... Aug *147
Pallady, P.H.
Compute relative humidity *quickly* . Nov 255
Palluzi, Richard P.
Flush away equipment problems ....Jan *104
Parkinson, Gerald
Boon for solids handling: Agglomeration ..... Aug *37
Compressor choices expand ..... Oct *47
Forum seeks answers to global pollution woes ..... Feb 48B
Geothermal energy gets a lift ..... Mar 54
Heat transfer perks up with new fluids ..... Feb *39
A hot and dirty future for baghouses ..... Apr *30
[illegible] fuel cells are sparking interest Aug 48
Novel separator makes its debut ....Jan 44
Pulse combustion gets a big tryout . July 51
Stricter standards for California diesel fuel ..... Jan 42
Sunny outlook for detoxifying wastes ..... Mar 60
Varied technical menu at metals meeting ..... Apr 50
Parkinson, Gerald & Eric Johnson
Designer catalysts are all the rage . Sept *30
Supercritical processes win CPI acceptance ..... July *35
Surging interest in leakproof pumps June *30
Parkinson, Gerald & Dennis Melamed
The debate starts anew on clean air. Aug *31
Pauls, Allen C. & others
The heat-transfer-fluid spectrum ... Feb 90
Pratt, Jon
Controller raises air and process capacity ..... Feb *151
Rader, Robert G. & others
Better absorption? Try a static mixer July *137
Raudsepp, Eugene
Change jobs or stay put? ..... June *161
Reynolds, John A.
Coming soon: New ANSI pump standards ..... July *98
Rhein, Reginald
Engineering Research Centers: The jury is still out ..... May *41
No big surprises in Bush's R&D budget ..... Mar 50
Red carpet welcome for U.S. wastepaper ..... Mar 64E
Report lambasts Superfund work... Mar 58
Roper, D.L. & J.L. Ryans
Select the right vacuum gage ..... Mar *125
Russell, Harold W.
Photography in engineering
Part 1: Applications ..... Jan *137
Part 2: Equipment (Be a photographic engineer) ..... Feb *137
Ryans, J.L. & D.L. Roper
Select the right vacuum gage ..... Mar *125
Sattler, Frank J.
Nondestructive testing in the CPI
Part 1: Improving quality through non-destructive testing ..... Apr 116
Part 2: Finding surface defects with nondestructive testing..... July *125
Part 3: Finding below-surface defects with nondestructive testing .... Sept *161
Part 4: Nondestructive testing via optical and acoustical methods ..... Nov *191
Part 5: Improving plant maintenance via nondestructive testing..... Dec *59
Seifert, W.F.
Matching the fluid with the process . Feb 99
Shelley, Suzanne
Women engineers: The playing field isn't level ..... Dec *47
Sheppard, Walter Lee Jr.
Inspection: Key to quality masonry lining ..... Mar *191
Shoaei, Mahnoosh & Jude T. Sommerfield
Draining tanks: How long does it really take?..... Jan 154
Short, Herbert
Europe's CPI lose some steam ..... Feb 48B
A first look at aramid processing ... Apr *37
$NH_3$ break thru: Small plants ..... July *41
Privatization triggers new challenges for U.K. chemical firms ..... Jan *30
Short, Herbert & others
Accelerating interest in dynamic simulation ..... Feb *30
$TiO_2$'s future is keyed to new technologies ..... Jan *37
Smith, Byron D.
Sizing the economic pipe..... Sept *201
Snyder, Dale R.
Understanding distributed control .. May *87
Sommerfield, Jude T. & Mahnoosh Shoaei
Draining tanks: How long does it really take? ..... Jan 154
Starks, Roy M. Jr.
Preparation: The key to crisis control June *171
Stettner, Morey
How to speak so facts come alive ... Sept *195
Subramaniam, T.K. & Joseph V. Cangelosi
Predict safe oxygen in combustible gases ..... Dec 108
Correction ..... Jan 1990 8
Tao, Bernard Y.
Numerical methods—CE Tutorial
7. Linear programming ..... July 146
Tassoney, J.P.
Fast analysis for multistage distillation ..... Oct 191
Toomey, Joseph E. Jr. & Jimmy C. Yu
Making organic chemicals via electrochemical processing ..... June *140
Trigueros, David & others
Synthesize simple distillation the thermodynamic way ..... Aug 129
Tzikas, Stephen A.
Save money on drum-quantity waste disposal ..... Feb *118
Ward, Thomas J.
Estimate profitability using net return rate ..... Mar *151
A new correlation for sieve trays .. June 177
Watkins, Don L. Jr.
Plagued by pumping problems? Consider the flexible-impeller pump ..... Jan *94
Witwer, Dale E.
Plastics: From pellets to products .. Sept *123
Wong, Wing Y.
Safer relief-valve sizing ..... May *137
Wyss, Stephen E.
How to organize pipe tie-ins for revamp projects ..... Feb 107
Yu, Jimmy C. & Joseph E. Toomey, Jr.
Making organic chemicals via electrochemical processing ..... June *140
Zanetti, Richard
Achemasia invests in the future .... Nov *58
Zanetti, Richard & others
Accelerating interest in dynamic simulation ..... Feb *30
Cogeneration's burning bright .... June *39


NOTES—*Illustrated; (C) Chementator; (Ed) Editor's Page; (N) Newsfront; (P.N.) Plant Notebook; (R) Reprints available


ADDITIONAL FREE

## Manufacturer's Literature

Circle those numbers on the following reader service card of products in which you have an interest and you will be sent the latest literature of manufacturers advertising in this issue.

800 Air Conditioning & Refrigeration Equipment
801 Centrifuges
802 Cleaning Equipment & Services
803 Compressors
804 Fans & Blowers
805 Computers for Process Control
806 Computer Software
807 Contract Maintenance Services
808 Conveyors & Elevators, Mechanical
809 Conveyors, Pneumatic
810 Disintegration Equipment
811 Drives, Variable Speed
812 Dryers
813 Dust Collectors & Separators
814 Entrainment Separators
815 Evaporators & Crystallizers
816 Filtration Equipment
817 Functional Fluids
818 Hose, Tubing & Fittings
819 Hazardous Waste Treatment Equipment
820 Heat Exchangers, Condensers & Coolers
821 Indicators for Temp., Press., Flow, Level, etc.
822 Insulation Materials
823 Kilns, Ovens & Furnaces
824 Lubricants & Greases
825 Maintenance Tools & Replacement Parts
826 Mixing Equipment for Liquids
827 Mixing Equipment for Solids
828 Motor Controls
829 Motors, Electric
830 Off-Stream Analyzers
831 On-Stream Analyzers
832 Packing Materials for Towers & Columns
833 Pipe, Plastic & Plastic-lined
834 Pipe Fittings & Couplings
835 Process Control Systems
836 Programmable Controllers
837 Protective Coatings
838 Pumps,Centrifugal
839 Pumps, Proportioning & Metering
840 Pumps, Rotary
841 Pumps, Vacuum & Ejector
860 Radioactive Scanning & Tracing
842 Reactors, Process Vessels
843 Recorders, Controllers & Transmitters
844 Refractories
845 Safety Equipment & Systems
846 Screens & Screening Equipment
847 Seals, Gaskets & Packing Materials
848 Steam Traps
849 Tanks & Liquid Storage Equipment
850 Valves, Automatic Control
851 Valves, Ball
852 Valves, Butterfly
853 Valves, Safety & Relief (Including Rupture Discs)
858 Valves, Draining & Sampling
859 Valves, Line Blind
854 Water Pollution Control Equipment & Systems
855 Water Treatment Chemicals
856 Water Treatment Equipment
857 Weighing, Feeding & Proportioning Equipment